September This Issue 210,000 10 Cents

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Please Mention Popular Mechanics

Popular Mechanics

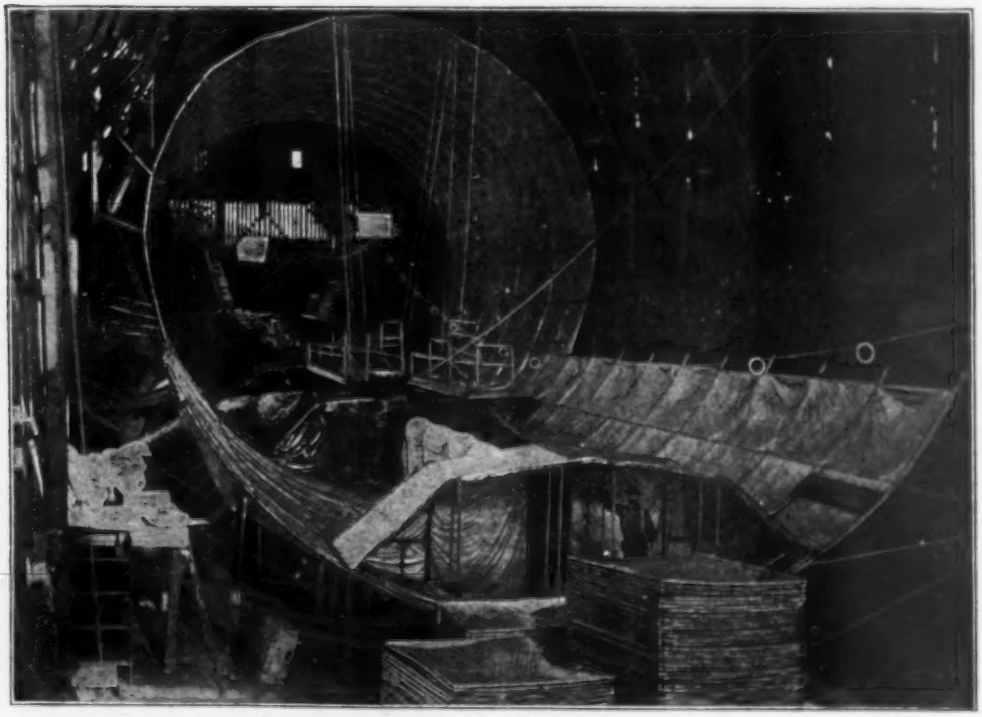
Written So You Can Understand It

Vol. 12 SEPTEMBER No. 3

DIRIGIBLE AIRSHIP WITH EVERYTHING INSIDE BUT PROPELLERS

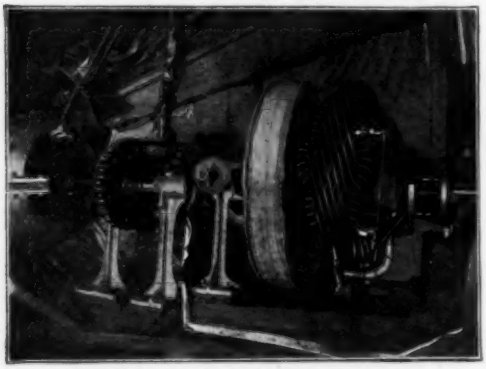
All dirigible airships that have been developed and have flown any distance have carried a car or cars under the gas bag in which the operators, engines and other mechanisms are contained. This dirigible airship differs from these others in the facts that all but the propellers are carried inside the main structural bag and that rudders are not required to steer it.

It is the idea of Mr. Tolliver, a California inventor, and now rests in its shed at Pleasanton, Alameda county, Cal. The length of the bag, which is rigid, being stretched over an aluminum frame, is 250 ft. and its diameter,



Showing Construction of Envelope and Its Interior

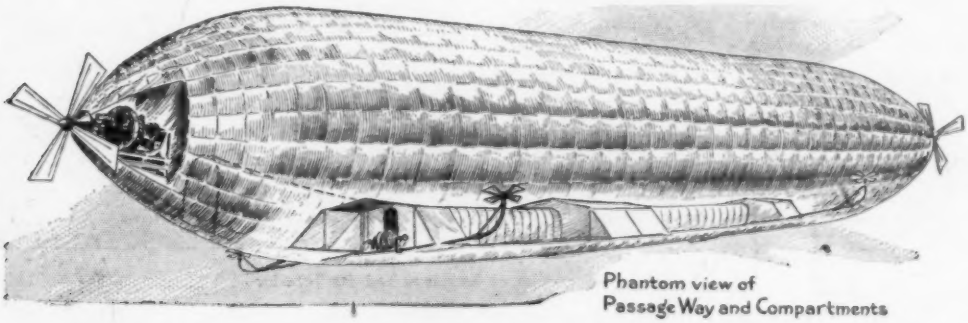
43 ft. Inner compartments contain the gas and fill all of the outer bag with the exception of a space at the ends, a passageway along its bottom, and



Drives One of the Propellers

three open spaces rising above the passage, one of which is for passengers and crew and the other two for the engines which drive the four side propellers. The airship is driven by six propellers, four being at the sides, as just mentioned, and the other two at the bow and stern. Four 22-hp. engines are required in all.

The method of steering by rudder, used on all other airships, has been done away with. The propellers are mounted on flexible shafts, these allowing them to be angled in any direction so that they may be used in pulling or pushing the craft in the direction desired. The exhaust from the engines is discharged outside the outer bag. The blades of the forward and rear propellers are reversible so that the airship can be propelled backward without reversing the motion of the shafts. The mechanism making this possible is of the same type as that in common use on the propellers of small motor boats.



Phantom view of Passage Way and Compartments

PHOTOGRAPHING THE INVISIBLE

There are many movements so rapid that the eye cannot see them, yet attempts are being made, and with partial success, to catch such movements with kinematograph cameras and reduce the action to a speed that can be clearly seen.

The picture-taking machine that has met with the most success so far is the invention of Privy Councillor Cranz of Berlin, and it takes no less than 5,000 pictures a second. The secret is the use for illuminating purposes of the electric spark, each spark representing a fresh picture. Among the sets of pictures taken of rapidly moving bodies is one which shows a bone being penetrated by a rifle bullet, and a bullet entering a bladder filled with water. The films, run through the projecting machine at a slower speed than that at which they were taken, show the bone hanging free, the bullet approaching it gradually, piercing and splitting it, and proceeding on its way. The films also show parts of the powder gases leaving the barrel of the gun before the shot.

For speed-testing purposes and for ascertaining the dynamic loss caused by the impact of projectiles with obstacles, the German machine may, according to the Picture Work magazine, be found of great value. It may also

be used in examining machinery for defects which mitigate against smooth working, and for such scientific uses as the studying of the rapid movement of the wings of insects.

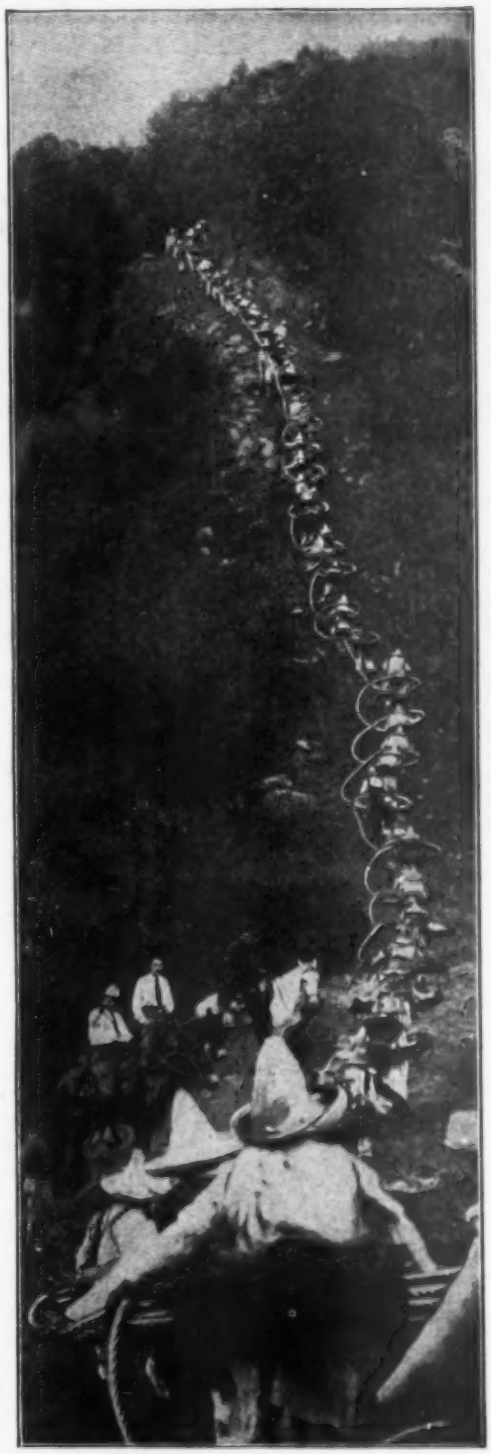
TRANSPORTING AERIAL CABLEWAY OVER MOUNTAIN TRAILS

The ingenious method of transporting a continuous line of 1¼-in. steel cable, 6,700 ft. long, over mountain trails in Mexico around the waists of 180 native Indians is shown in this illustration. The cable weighed nearly 3 lb. per foot, and each Indian carried a coil weighing approximately 100 lb.

The cableway was for a copper company in Southern Mexico, in a part of the country where it was impossible to secure mules and where the narrow trails made transportation by wagons or other vehicles out of the question. Therefore a section of about 30 ft. was looped around and around into a coil large enough to allow an Indian to step inside of it. Then 7 or 8 ft. further on another coil was made and an Indian stepped inside, this procedure being continued until 180 coils had been formed. The Indians then lifted the coils to the height of their waists and the march over the rocky, uneven trail commenced.

DUST IN CITY AIR

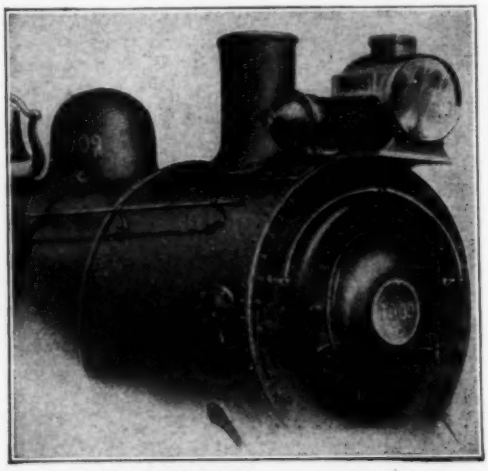
The Chicago public laboratories recently made tests to determine the amount of soot and dust deposited from the air in that city. The acreage deposit, as estimated from samples collected at eight different points of different heights during a period of four weeks was, approximately, at the rate of 8.5 tons per acre, per year. On the Board of Trade building, 110 ft. above the street level, the estimated annual deposit was 19.5 tons. On the County building, 160 ft. above street level, the amount was 7.8 tons, and on the Reaper block, 12 ft. above street level, 12.6 tons.



Ingenious Method of Carrying 6,700 Ft. of Cable

LOCOMOTIVE ELECTRIC HEADLIGHT CONTROVERSY

Agitated by the passing of a law in North Carolina to compel railroad companies to equip their locomotives with



Electric Headlight on Locomotive

electric headlights and legislation toward the same end in other states, several railroads have made experiments which they claim prove such headlights to be far from satisfactory.

Tests made by the Great Northern railroad seem to show that the intensity of the rays destroys the power of the engine crew to distinguish the color of the various signal lamps. Sitting behind the strong rays for a time produces fatigue of the eyes, and the passing of opposing trains on parallel tracks produces temporary blindness. It is also claimed that an engineer would have to retire from the service after less than a year of riding behind such lights, on account of incipient color blindness.

Legislators point to the powerful electric headlights carried by high-speed cars on electric roads as proof that the light is not so disastrous as steam-road men claim, but the latter insist that the conditions on the two types of roads cannot be fairly compared.

The illustration shows an electric headlight outfit for locomotives.

THE WASTE IN DISCARDED TIMBER

The short and odd lengths of timber left in the forest because the lumberman cannot find a paying market for other than the lumber cut from logs of regulation length is a waste that is so tremendous that the forest service for the National Conservation Commission is endeavoring to ascertain from lumber manufacturers to what extent more careful specifications might reduce it. If specifications were actually drawn by builders and architects for lengths actually used, the short logs would be in demand. Statistics gathered show that in some cases as much as 25 per cent of the felled trees are never hauled from the woods, simply because specifications cling to conventional lengths, and that lumber in long lengths is frequently ordered for use in lengths of from 1 to 6 ft. Yet the short lengths, which would exactly and economically meet these requirements, cannot be sol

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HUGE PORCELAIN BATHTUB

The bathtub shown in this illustration is claimed by its manufacturer to be one of the three largest in the world. The other two are in the homes of William K. Vanderbilt and Harry Payne Whitney. They are made of porcelain in one solid piece and are 6 ft. 10 in. long, 44 in. wide, and 23 in. in depth.

Solid Porcelain Bathtub of Large Dimensions

In the interior are steps. Each tub weighs 1,400 lb., and has to be set on a specially constructed floor.

TIDE LEVELS AT PANAMA

The conformation of the Isthmus of Panama makes the shore on the southern side present a crescent or concave line to the Pacific ocean, and this, with other conditions, brings about a tide rise 23 ft. in Panama Bay, which is the Pacific outlet of the canal. On the other hand, the shore line of the Isthmus on the Atlantic side is convex and borders on the open Caribbean Sea with a tide rise of not over 2 ft. This makes a mean tide of 11½ ft. on the Pacific side and of but 1 ft. on the Atlantic side. High tide at Panama is therefore 10 ft. higher than at Colon and low tide is 10 ft. lower.

AUTO JUMPS BRIDGE GAP

Leaping the gap, as performed in a circus, is a simple feat as compared with the experience of Dr. William E. Durr, of Milwaukee, when his automobile made a spectacular jump across a 10-ft. space between the rapidly rising wings of a bascule bridge in that city. The physician was making an emergency call and approached the bridge viaduct, which is some 50 ft. above the river, at a fast speed. He did not hear the warning cries of the bridge-tenders until his machine was upon the north lift. Then he found that the bridge was ascending, with the south arm a little below the one on which he was trapped. Throwing

"Leaping the Gap" in Reality

on full power he leaped the 10 ft. of space between the two arms and shot down the opposite incline.

MOTORCYCLE MILK CART

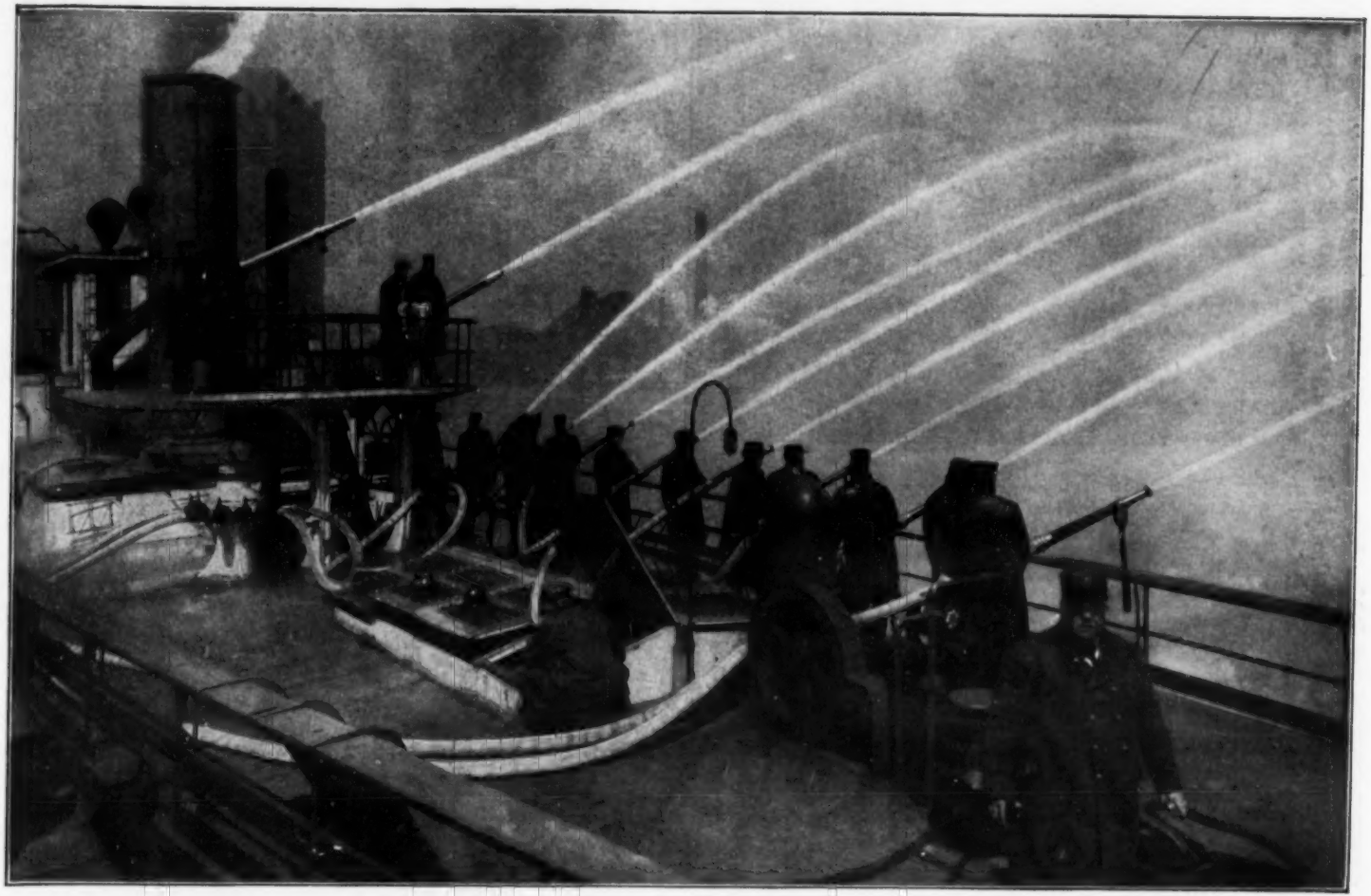
In the near future the early-riser in the cities may know of the milkman's

The Motorcycle Milkman

approach by the "chug chug" of a motorcycle instead of the "clop clop" of a horse's hoofs. The illustration shows a new sanitary, motorcycle-driven milk cart for milk delivery in New York.

GERMAN POTATO-DRYING PLANTS

Owing to the overproduction of potatoes in Germany, several potato-drying plants are being operated, the process being somewhat similar to that of drying apples. It is an industry but little heard of in this country, and its product is a potato preparation the American housewife is not yet familiar with. The number of such factories in Germany is increasing, due partly to the advancing prices of grain. To produce 220 lb. of dried potatoes, 830 lb. of tubers are required, and the product is worth from $3.80 to $4.30.



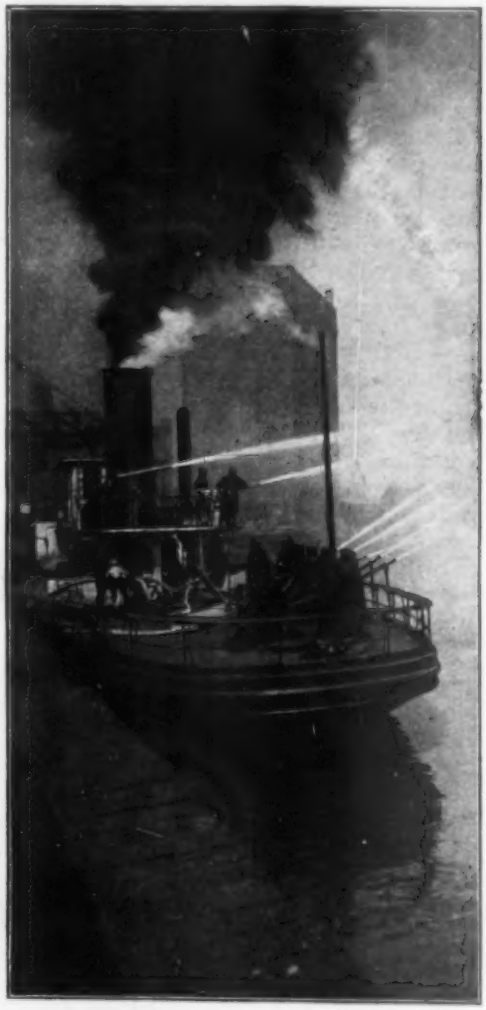
Two Powerful Water-Guns and Eight Lines of Hose in Action

POWERFUL FIREBOATS CONTROLLED LIKE ELECTRIC CARS

Chicago's two new and powerful fireboats, the "Graeme Stewart," and "Joseph Medill," by an ingenious coupling up of electricity and steam in a manner unlike that of any other vessel in any part of the world, are controlled from the pilot house in the same manner that a motorman controls an electric car. Alongside the steering gear is a controller by means of which the captain can start the steam turbines and send the boat ahead or astern, at low or high speed—a feature of utmost importance when the boat is fighting a fire from positions that may need continual changing to avoid falling walls. A technical reader, familiar with marine engines, will immediately ask how it is possible to reverse and run the boat backwards with steam turbines, and his answer is the above mentioned coupling of steam and electricity.

The power plant consists in reality of two duplicate plants, which can be run alone or together, each unit consisting of a steam turbine of 660 hp., a 200-kw. generator, a 4,500-gal.-per-minute force pump, and a 250-hp. electric motor. Midway on the shaft of each turbine is one of the electric generators and at the other ends of the shafts from the turbines are the central-drive rotary pumps that feed the fire-fighting monitors and hose connections. The 250-hp. motors are direct connected further astern to the two shafts of the twin screws which propel the boats, and these are connected by cables to the generators on the turbine shafts. To make the idea still more clear it is well to state, therefore, that the energy of the steam turbines is converted into electricity to propel the boat, while the same shafts that drive the generators also drive the pumps. Consequently, the boats are driven by electricity, which allows of quick reversing and direct control from the pilot house, while the pumps are driven by steam.

The boats are 120 ft. long, with a 36-ft. beam, and their fire-fighting battery, as well as the means resorted to

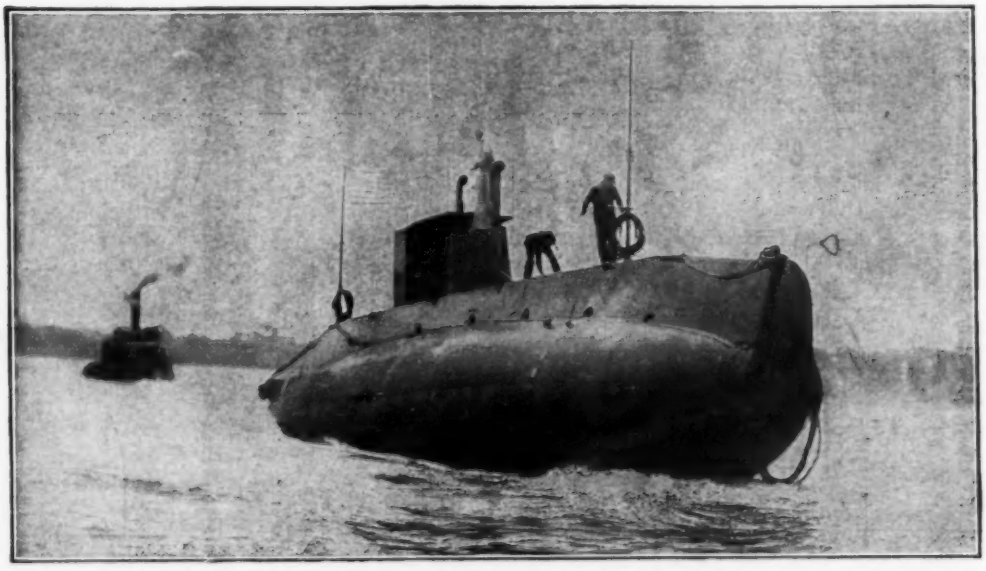


Another View of the Fire-Fighting Battery

by which they can anchor solidly anywhere in the river instead of having to fight a fire alongside a dock, are as revolutionary and interesting as the power plant. The main water battery consists of two great "water-guns" that can be swung in any direction or at any angle upon their standards.

These standards are mounted on a platform just over the positions of the pumps, each great nozzle taking the entire force of 4,500 gal. of water per minute from the pump under it, when desired. Or, should the necessity require it, one nozzle, by inserting a slightly larger head, can take the combined 9,000 gal. per minute of both pumps and throw it in one huge, shattering stream. Each nozzle, with a 2-in. opening, and each receiving the full force of the pump under it, can throw a powerful stream fully 500 ft., while one of them, with a 3½-in. opening, and receiving the water from both pumps, can throw a stream nearly twice the size about the same distance, perhaps a little further. In addition to these justly named "water-guns," the fire-fighting battery consists of 16 connections for hose, but, of course, the larger the number of lines of hose used, the less is the force of the streams from the water-guns. It would, however, be impossible to use the water guns on many fires, as their force would soon batter down the walls of an ordinary brick building, if the fighting were at close range. Also, should the necessity require, lines of hose could be run from these connections to supply fire engines at a fire several blocks away from the river. In fact, the boats could be used from several points in the river or from the lake front to fight any fire in Chicago's business district.

The third but least important feature of the boats is the means resorted to to anchor them at any distance from the fire being fought, thus precluding the necessity of tying them to docks. These are the three "spuds" or shafts. One of these can be seen close to the smokestack in the illustrations. The other two have been driven into the river bottom, the top of one just showing. These spuds are 23 ft. long and 18 in. in diameter, made of sheet steel and reinforced with angle-irons. Each one is operated by a separate steam engine, the gears of which engage with a row of teeth up one side of each spud. When the boats are in motion these spuds are drawn up, but when fighting a fire they are driven into the river's bottom, holding the boats solidly anchored in position. Two of the spuds are forward, one on each side of the pilot house, and the third runs through the center of the boat near the stern.



The U. S. submarine "Snapper" recently launched at Quincy, Mass., is shown in this illustration. It is one of the most powerful submarine fighters in the world, and the United States Navy is gradually acquiring a large fleet of them.

CEREMONIAL DISH OF INDIAN CHIEF

This huge wooden basin of the chief of an Indian tribe in British Columbia would at first lead one to believe that the Indians of the West are becoming so civilized that a bathtub is a natural requirement. This kindly idea, however, must be dispelled; the tub is a ceremonial dish used at Potlach feasts, at which times hundreds of blankets are given away to the guests as a demonstration of the high standing and power of the host.

Serving Dish in Which a Man May Recline

THE WRIGHTS IN AMERICA

By the time this issue reaches the public the Wrights will probably have successfully fulfilled the requirements of the United States army, judging from what was accomplished in Europe, but up to July 16, at least, the attempts of the Wrights in America were disheartening, as is shown in this report of the activities at Fort Myer. Orville Wright has been operating the machine, while Wilbur assisted.

July 2: Slight accident occurred which tore the fabric of one of the planes and injured the skids. Orville returned to Dayton after new material.

July 8: Machine completely repaired and ready for flights on July 9, although Wilbur warned the crowd that in all probability no flights would be attempted.

July 9: Secretary of War Dickinson and Secretary of the Navy Meyer spent the afternoon at Fort Myer expecting one of the Wrights to fly. The machine was ready for the trials, but a 12-mile breeze is said to have interfered.

July 12: On the evening of this date, just before dark, the aeroplane, with Orville driving, made the first flight after its long vacation. It flew for 5 min. 40 sec., descending to earth at the end of that time under complete control. The speed was between 40 and 43 miles an hour.

July 13: Two flights were attempted, but the machine behaved like a naughty child. It just wouldn't fly for more than a few hundred yards. The first time it flew two-thirds the way down the field. The second time it flew the full length of the field before Orville was forced to make a landing. Then one of the skids hit a hummock and was broken. After that the brothers gave up for the day and boarded a car for Washington. They were as imperturbable as icebergs, and apparently as unconcerned as if carved out of stone.

"The machine didn't have enough speed," said Wilbur, "and there was a little breeze blowing with it, which retarded it. Of course, you know that it's easier to fly against a wind than with one."

A pebble in a loaf of bread broke a woman's tooth as she was biting into a slice and the courts awarded her $25 against the breadmaker.

EXCEPTIONALLY BEAUTIFUL BRIDE'S BOUQUET

Anyone can make a bride's bouquet, but not everyone can make them with

Courtesy Florists' Review
Remarkably Beautiful Bride's Bouquet

the light and airy grace demanded by many customers. The bouquet illustrated is the work of a Toronto, Can., florist, and is called the "Empire Shower." The materials are the only things conventional about it, and include lilies of the valley, white lilac and maidenhair fern. The shower is of crystal net and the ties of satin duchess ribbon and crystal net, with silver tassels to finish the ribbon.

The beauty of the bouquet lies in its lightness. It is large, without being heavy, and full, without being stiff. The loose and graceful arrangement of the whole makes it a masterpiece.

REOPENING OF SOO LOCKS NOTABLE FEAT

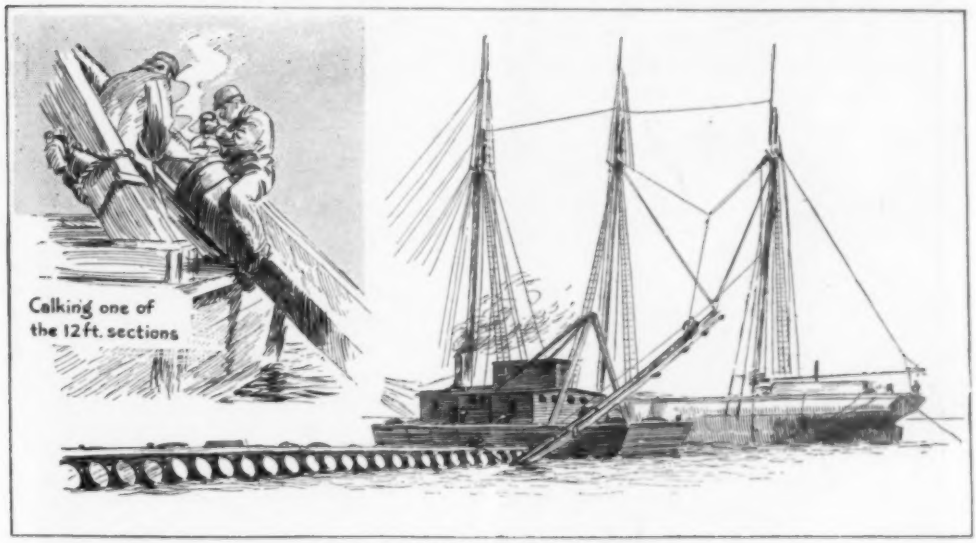
The rapidity with which the Canadian lock at Sault Ste. Marie was repaired after the accident of June 9 (fully described in the August issue) makes the feat a notable one. Regardless of the fact that many persons who might be accredited with sufficient knowledge to make their statements of weight insisted that the task would take all summer, the great passageway was again in operation on June 21, only 12 days after the accident occurred. Because some of the wickets of the movable dam, used to check the water, fouled an obstruction in the bottom of the canal the complete closing off of the water was delayed until June 13, but the demonstration given of the possibility of controlling lock canals when gates are carried away is of great importance.

LAYING PIPE IN NARRAGANSETT BAY

In the task of furnishing a water supply for Fort Greble, located on Dutch Island in Narrangansett bay, it was necessary to lay a submerged line of cast-iron pipe, 6 in. in diameter, for a distance of 4,150 ft. The line starts from the Rhode Island mainland and the supply is spring water taken from a reinforced concrete reservoir, having a capacity of 500,000 gal., located at Saunderstown.

The average depth of water in which the pipe was laid is 35 ft. at low tide, and the maximum depth, 60 ft. Great difficulties were encountered because of

the strong undertow in the bay, there being a tidal current of 4 miles an hour with a rise and fall of 5 ft. In order to resist this current and undertow, heavy ship and mushroom anchors, weighing more than ½-ton each, were used to hold the dredge in place. These anchors were each provided with 600 ft. of cable.



Lowering Pipe into the Launching Tube

The equipment for laying the pipe, included, besides the dredger, a 130-ft. schooner to carry the pipe and to provide a platform for connecting it, and a small attending dredger. The average weight of a 12-ft. section of the pipe was ½-ton, and four of these sections were connected on the schooner to make one large section. These 48-ft. sections were then lifted into a wooden chute, 100 ft. long and inclined 45 deg., and lowered to the bottom. The lower end of the chute had a number of 12-ft. jointed sections, and was held clear of the bottom by cables attached to a 100-ft. barrel float on the surface. The launching ways are shown in the illustration.

When the work was completed air was pumped into the pipe, expelling the water. Divers then followed the line, caulking the joints with pneumatic hammers where the escape of air designated leaks.

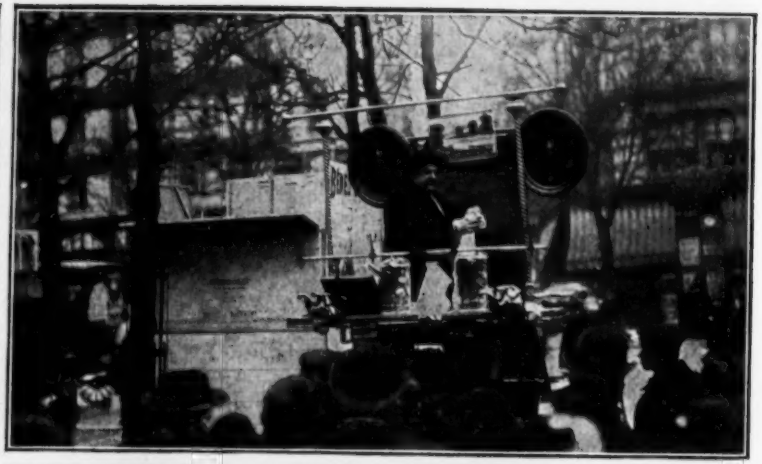
FLOATING SLAUGHTER-HOUSE

A steamship 420 ft. long, with a beam of 54 ft., has been converted into a floating and traveling slaughter-house, the first thing of the kind in the world, by an English packing house that will use it in Australian waters. Distributed over the three decks will be accommodation for cattle pens, killing room, oleo and extract plants, a large cold storage, and can-making and canning machinery, as well as cooperage and case-making plants.

Instead of Western Australian stock having to be shipped from Wyndham to Perth, a distance of more than 1,500 miles, they may be killed at the former place on the floating slaughter-house. The prime beasts can then be frozen, the rough stuff dealt with in other ways, and by-products extracted. It costs about $14 per head to ship live stock from Wyndham to Perth, whereas, slaughtered, they can be carried for half that price, while all the wasting and knocking about incurred in transit will be obviated.

The hydrographic bureau of the U. S. government has just issued the first map ever made of the waters of the South Atlantic Ocean.

Woman Chiropodist on the Street
Advertising Hair Tonic



Practical Demonstration of Tooth Paste
A Street Artist

STREET LIFE IN PARIS

Paris, in warm weather, is an out-of-doors city, the Parisian having no greater delight than gayly traversing the many boulevards and seating himself or herself at the tables that dot the pavements (sidewalks in America) in front of the many eating places, there to satisfy hunger and imbibe cool beverages. The street fakirs and venders in Paris are given the freedom of the boulevards in a way that would scandalize an American police department, and hold such a place in the hearts of the people that were they not there, the streets would take on a less interesting aspect. A police officer never once dreams of disturbing them in their sales, even though pedestrians are often obliged to step out on the street to pass.

Photographs While You Wait

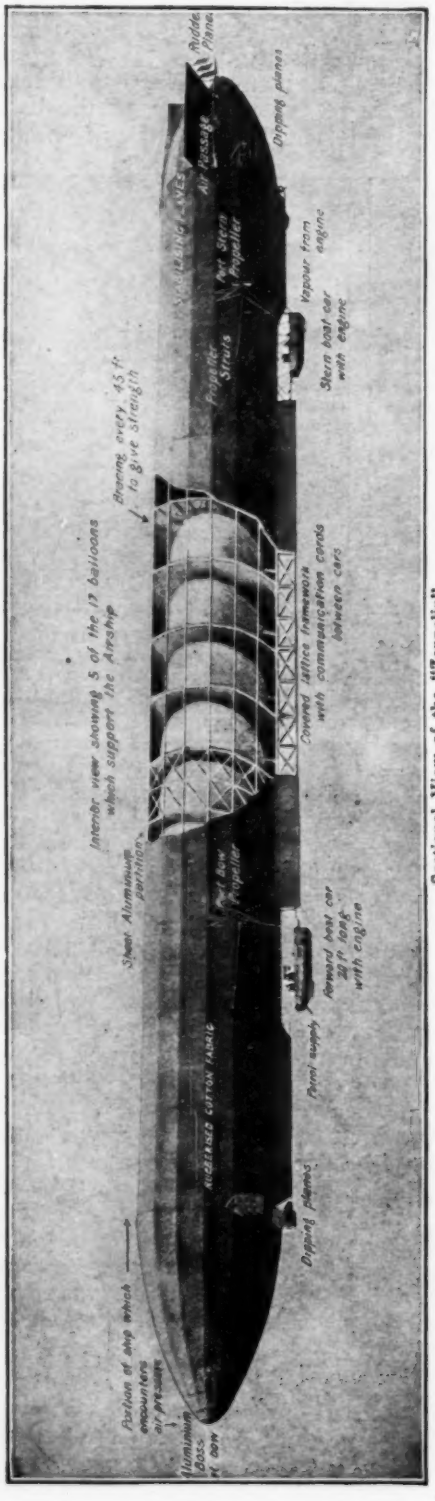
A Public Letter Writer

The illustrations are an excellent example. One of them shows a woman corn doctor at work on the foot of a male subject. Neither one is afflicted with self-consciousness as the crowd looks on. At another stand, planted in the middle of a sidewalk, hair tonic is being sold, and the women venders believe that the quality of tonic is best advertised by the quantity of hair they display. A tooth preparation is sold by demonstrating its properties on members of the crowd free of charge; an artist paints his pictures on the boulevards, thus saving studio rent and advertising his art; photograph studios dot many corners, and letter writers of the street write the confidential letters of those who in younger days did not spend enough time on education.

GROWTH OF THE AUTOMOBILE INDUSTRY

In 1898 there were no more than 200 automobiles made and put into use in the United States, according to H. F. Cuntz, of the automobile manufacturers' association, yet this year, only a little more than 10 years later, the number made and sold will approximate 82,000. Next year, says the manager of the American association, 200,000 cars will be built. This statement he makes after a careful compilation of figures received from manufacturers of entire cars and of parts of cars. He also says that of this number 165,000 will be pleasure cars; 30,000 will be high-wheeled autobuggies made by carriage concerns, and 5,000 will be steam and electric carriages and commercial trucks.

A New York family has had moving picture films made which show the frolics of their 3-year-old boy, so that he may see them when he grows up.


Rudder Plane
Air Passage
Diping planes
Port Screw Propeller
Vapour from engine
Stern boat car with engine
Propeller Struts
Bracing every 45 ft. to give strength
Interior view showing 5 of the 17 balloons which support the Airship
Covered lattice framework with communication cords between cars
Sheet Aluminum partition
Port Bow Propeller
Forward boat car 22 ft. long with engine
Petrol supply
Diping planes
RUBBERIZED COTTON FABRIC
Portion of ship which encloses air spaces
Aluminum Boss

Sectional View of the "Zeppelin"

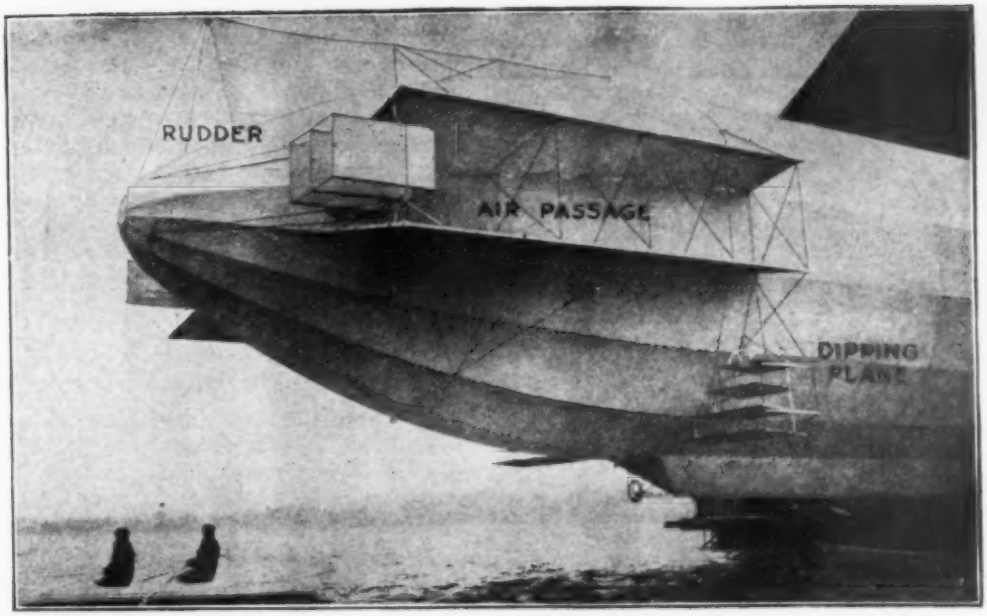
NAUTICAL SCHOOL OF COOKERY

In the ordinary course of affairs, the chef on a ship learns his profession by working up from the lowest rung of the culinary ladder, but at North Shields on Tynside, England, there is now a school in which men and boys are trained in the cookery art. The lessons include the preparation of a full course dinner every day, all made out of such foods as are allowed on shipboard. One dinner for instance, includes pea soup, curried prawns, sea pie, boiled salt beef with cabbage and potatoes, and the choice of apples and rice, or jam roly-poly for sweets. The school has been in existence for one year, and in that time 221 men and boys have entered the course of training, 199 having already successfully passed and become qualified sea cooks. The historic expression "son of a sea cook" thus attains a distinctly professional meaning.

ZEPPELIN FLIES 850 MILES

The English press has again and again in the past several months published reports of airships that have been vaguely seen hovering over different parts of the country. Such reports are undoubtedly the frightened imaginings of the people living along the coasts, and as such are laughed at by the government, but that such a demonstration is possible should Germany desire has been proved a startling possibility by the wonderful 850-mile, record-breaking flight of Zeppelin's great dirigible airship.

It rose from its house on May 29, and for 37 hours sailed through the air, covering a distance of 850 miles, a flight long enough to have started from Cologne, Germany, flown all around London and returned again. True, the great aerial ship was badly damaged by colliding with a tree in an open field near Goeppingen after flying this distance, but the accident does not dim the triumph of the world's greatest aerial feat. The envelope was torn and



How the Airship Is Steered

the prow broken, but these injuries were soon repaired and the great ship rose again to complete its return journey.

The flight brings still more clearly before the powers what aerial supremacy will mean in the next great war, and the accident proves the rigid type of dirigible airship much superior to the non-rigid. Had an airship of the latter type received such a blow as the "Zeppelin" it would have been completely wrecked, while the latter, after a few temporary repairs, was ready to soar again.

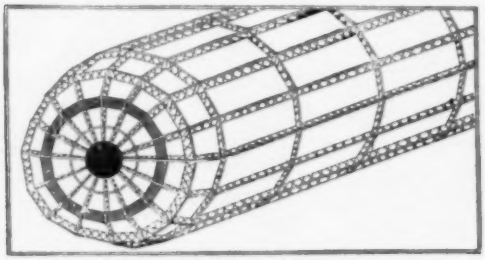
The enthusiasm with which Germany received this latest demonstration of its supremacy as an aerial power was almost too great for expression, as was also the opposite effect in England.

The Zeppelin airship is continually being improved, as is shown in these illustrations. Inside its huge envelope are 17 separate gas bags or balloons, the bursting of any one of which will not affect the others. Sheet aluminum partitions divide each of the bags, and the space between the bags and outer covering is filled with air. The two small illustrations show the rigid metal structure of the airship and a closer view of its steering arrangements. In the latter are shown the triple-planed rudder which steers it to right or left, and the horizontally arranged dipping planes which enable it to be either raised or lowered in the atmosphere.

Accident on May 31: The Airship Ran into a Tree on Rising

The two planes which project from the sides of the envelope act as stabilizers

and form a passage in which the air flows to the rudders, giving them



The Rigid Metal Structure

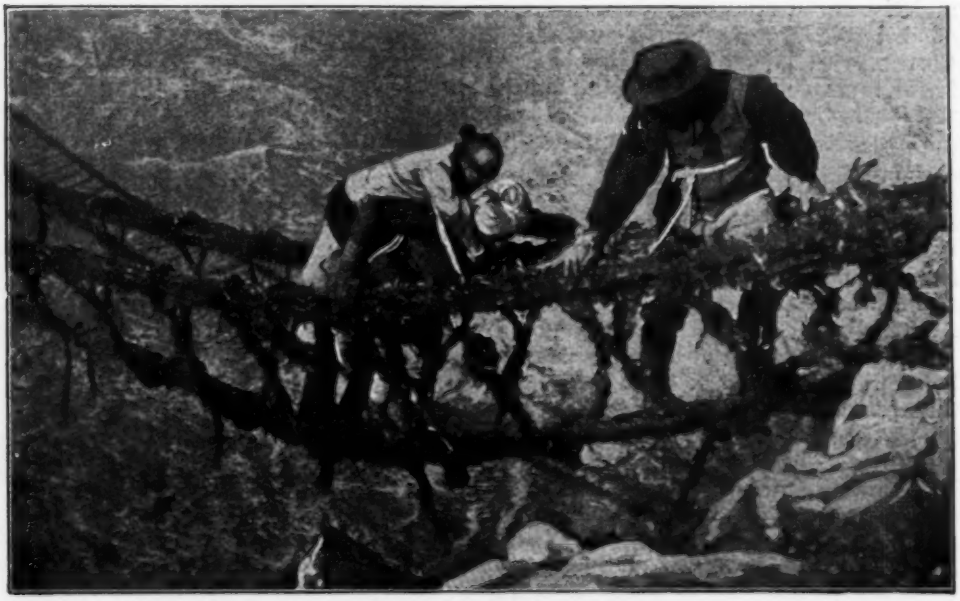
greater steering power. Dipping planes are also arranged at the bow.

PERILOUS WICKER BRIDGE ON PATH TO HIMALAYAS

The Himalaya mountains, the great range of Asia having the loftiest peaks in the world, has become only second to the Alps in the interest of mountain climbers, but all the dangers attending such a means of adventure are not confined to the mountains themselves, as this illustration shows. In the preliminary march, the bridges to be crossed offer difficulties to overcome that would tax a trained acrobat. They are dizzy, gymnastic contrivances of wicker and hemp, from which a stumble would mean a fall hundreds of feet into the rushing water below. They are made of three cables of tightly wound strands of wicker, bound together in a sort of cradle by hemp. The lower cable forms the bridge platform. The illustration shows an Indian porter carrying a native woman over on his back. Her eyes are bound so that she may not become dizzy.

PARIS AUTOMOBILE SHOW ABANDONED

The annual Paris automobile show, which, for the past few years, has been one of the most important industrial and social events of the French capital, has been abandoned this year, and the magnificent Grand Palais will remain empty and deserted through the months of November and December. The abandonment of the show is accredited to the fact that in the past couple of years the changes in automobile design have been so slight that the necessity of an auto exhibition has greatly lessened. Also that the country has no longer any need to be converted to the use of motor cars.



Asiatic Bridge of Wicker Cables

SINKING WELL THROUGH SANDSTONE

Directly under the box occupied by three workmen in this illustration is the opening of a well that was sunk under considerable difficulties. It is

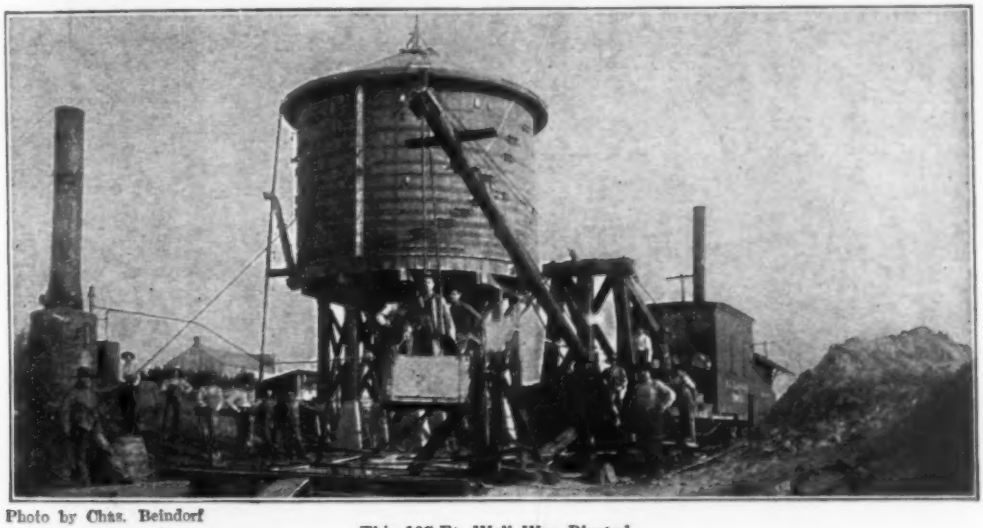


Photo by Chas. Beindorf

This 107-Ft. Well Was Blasted

located at Cement, Okla., has a depth of 107 ft., a diameter of 20 ft., and was blasted most of its depth through a kind of red sandstone. The difficulties encountered when the work was first started caused the railroad to abandon it for a couple of years, but the other water available was so disastrous on locomotive boilers that the work was recommenced and finished. The men were lowered to their work and the excavated material lifted out by the hoist shown.

YELLOWSTONE PARK HYDRO-ELECTRIC PLANT

A complete hydro-electric plant, including penstock and concrete powerhouse, is being installed at Fort Yellowstone to furnish power and light throughout the great national park. The plant will consist of three generators connected to a water wheel operating under a head of approximately 275 ft. The water will be carried to the powerhouse by a 26-in. steel penstock, which will be provided with automatic relief valves and large air chamber to aid in the regulation of the turbines, this presenting some difficulties owing to the length of the penstock, which is approximately 2,200 ft.

BERLIN'S FIRST AUTO-HEARSE

Germany is somewhat behind the United States in this branch of automobile utilization, although far in advance of our and all other countries in her different types of war automobiles. Nearly every large city in the United States can claim at least one

First of Its Kind in Berlin

automobile hearse, but the one shown in this illustration is the first to make its appearance in Berlin.

SPRINKLING THE CAPITALS OF EUROPE—In no other cities in the world can such a mingling of old and new methods of street sprinkling be found as in the capitals of Europe where, almost side by side, may be seen sprinkling carts of ancient make and up-to-date automobile

sprinklers. The first three illustrations all show sprinkling carts now in use in Berlin. The first is Berlin's latest automobile sprinkler; the second, an ordinary sprinkling cart, and the third is a push cart sprinkler. Number 4 shows three sprinkling carts at work on a race course and Number 6 is a sprinkler that sprays the entire width of a pavement. Numbers 5, 7 and 8 are sprinklers used in Paris, the first being an automobile sprinkler, the second, the hose system still much in vogue, and the third, a one-horse cart. Number 9 shows workmen washing down a Vienna street; Number 10, a Belgian cart being filled by a woman, and Number 11, a Madrid sprinkler. The latter is rather curious, the sprinkler head being swung back and forth by a man who walks some distance behind and pulls it with a rope.

THE FLYING DRAGON

The picture shows a respectable and prosperous Chinese beckoning to an aerial monster, which he is apparently coaxing to eat out of his hands. This

A Chinese Sport

proves that the camera may be a very plausible and entertaining liar, for the facts in the case are quite otherwise. Indeed, the pig-tailed gentleman is so absolutely master of this tameless denizen of the upper air, that he offered to sell me the dragon outright for $5, the same being a Frankenstein monster of his own creation and well worth the price.

Yes, you've guessed right; it's a paper kite, but such a kite! It is about 12 ft. long, and is composed of 26 circular frames of bamboo, over which are stretched as many 8-in. circles of silky paper. The upper halves of the discs are painted bright red, the lower halves are white, presenting the appearance of a dragon's belly, and emphasizing the writhing and contortions of the monster. The nose projects from the face on the first disc and the eyes are fixed on pivots so that they whirl in the wind, lending a pleasing animation to otherwise immovable features.

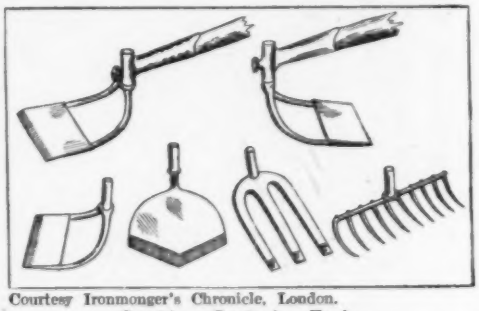
The rigging of fine cords which holds together this 26-jointed nightmare is very complicated and requires nice balancing; in fact, there is a vast amount of patience and skill and full five-days' labor represented in the fragile toy.

The picture was taken in a vacant lot near "Chinatown" in Los Angeles, Cal. It is curious to note that the kite flyer is a full grown man who has not taken the trouble to bring any of his youngsters along to provide an excuse for indulging in this juvenile pastime, or as the Chinese would put it "to save his face."

In Chinatown, you see, the flying of kites is considered a high art.—Contributed by Charlton Lawrence Edholm.

MULTIPLE HOE AND RAKE SET

This multiple hoe and rake set combines almost everything that is required of the kind in an ordinary garden. A special feature is a hoe with a reversible blade, which can be easily set for use as a "Dutch" hoe or draw hoe as desired. A rake, earthing tool, or sharp-pointed hoe, can also be fitted to the one socket and handle. Each tool is provided with a top pin, which fits in and revolves in a hole in the socket. The tool is fitted in posi-



Courtesy Ironmonger's Chronicle, London.
Combines Gardening Tools

tion by a strong screw, which binds in a tapered hole in the pin in such a way that neither tool nor screw can work loose.

DENATURED ALCOHOL (INDUSTRIAL ALCOHOL)*

By Dr. Harvey W. Wiley, Chief of Bureau of Chemistry,
U. S. Department of Agriculture

[On January 1, 1907, Congress removed the tax of $1.10 per gallon on alcohol to be used for industrial purposes, but required that the alcohol should be "denatured" or made unsuitable for use as a beverage. The public confidently expected that without the former tax alcohol would be so abundant and cheap it would immediately become a household commodity in general use for lamps, cooking, and heating. Great hopes were entertained for its use in gas engines both stationary, marine and in motor vehicles. It was announced that every farmer could make enough alcohol from his frozen potatoes and unmarketable fruit and vegetables, at practically no expense, to run all his farm machinery. What Denatured Alcohol is, how made, why it has not come into large consumption, and the future prospects of its utility are fully described in a series of four articles by the eminent authority, Dr. Wiley.—Editor's Note.]

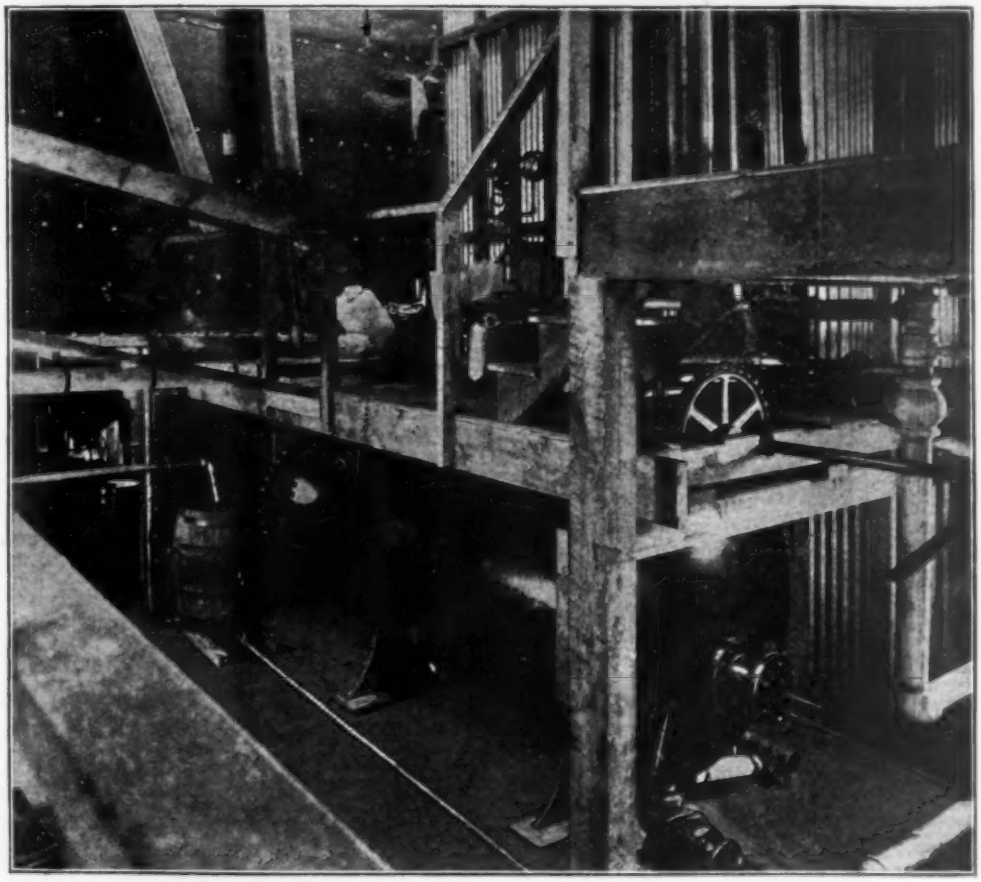


Fig. 5—Closed Mashing Apparatus of a Small Distillery

ARTICLE I.

How Alcohol Is Produced

Alcohol. When a carbohydrate, such as starch or sugar, is subjected to the action of yeast, there is formed a substance of peculiar characteristics commonly known as alcohol. Chemically, there are a great many alcohols, but only two of them are produced in large quantities, viz., wood or methyl alcohol and common or ethyl alcohol. When-

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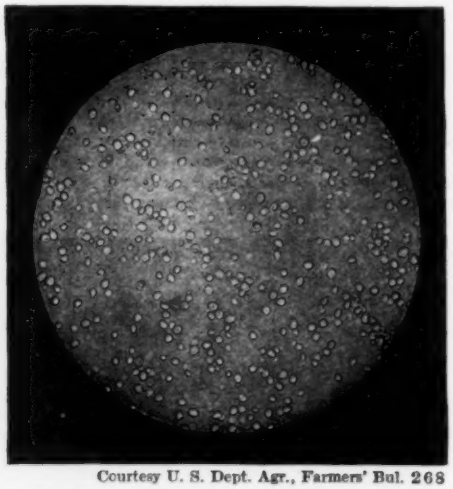
ever the term alcohol is used alone, it refers to the latter substance. Other alcohols are used largely in the arts, especially for the production of artificial



Courtesy U. S. Dept. Agr., Farmers' Bul. 268
Fig. 1—Photomicrograph of Brewer's Yeast

flavors and among these the most important are propyl, butyl and amyl alcohols. These are all formed, but in relatively small quantities, during the fermentation which produces ethyl alcohol, and are therefore described as congeneric therewith. A great many other substances besides these alcohols are produced during fermentation, but ethyl alcohol is always the chief one. A product of fermentation in its natural state contains, therefore, a large number of bodies, each one of which gives the mixture some quality and the general character of the product is the sum of these individual constituents. Chemists have estimated the total number of these products at twenty or thirty, but there are doubtless many others which have not yet been isolated. A product of fermentation is consequently a very complex body.

Fermentation. The act of fermentation is one of the most interesting processes of nature. It is produced by a body called a ferment or enzyme, which of itself does not become a part of the product but simply sets up the chemical reactions which result in the breaking up of one body and the production of derivatives therefrom. This process is what the chemist calls "katalysis" and the ferment is known as a "katalyzer." Common sugar resists the action of this ferment unless it is first changed into less complex forms known as invert sugar. This change is easily effected, either by a species of ferment known as "invertase" or by heating with acids. Starch also resists the action of an alcohol ferment unless it is first converted into a sugar by the action of a ferment called diastase or by heating with a dilute acid. In the former case a sugar, "maltose," is formed, and in the latter case a sugar, "dextrose." These conversions when produced by a ferment are true forms of fermentation, but when caused by heating with an acid are simple chemical processes to which the general term "hydrolysis" is applied

The enzymes which convert starch into maltose are generated on a large scale by the process of sprouting cereal grains known as malting. All kinds of cereals produce diastase by malting, but barley does so in a preeminent degree and hence barley is

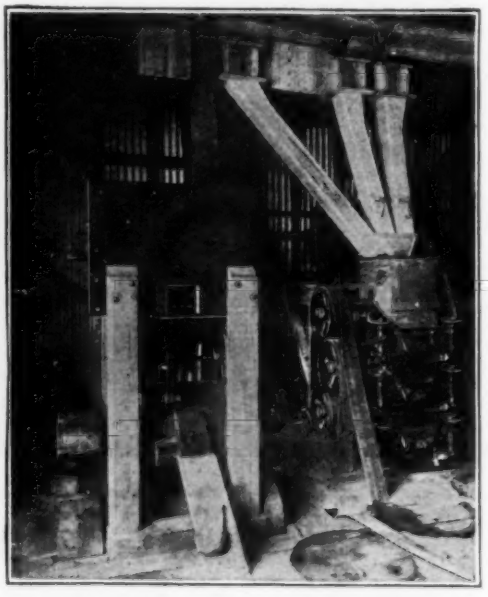


Fig. 3—Grinding Room of a Small Distillery

almost universally used for the production of malt, and the commercial term

"malt" without any limiting word always implies barley malt.

Malting. Usually from 7 to 14 days are required to complete the malting process, depending on the temperature of the process. The slowly formed malt is considered to be of superior quality. The grain is spread on a floor in a layer of a foot or more in depth—well moistened and occasionally turned until the sprouts are well formed. The green malt is then dried first at a low temperature and when the moisture is mostly expelled at a higher temperature until only a small quantity of water remains. From 10 to 15 per cent of good malt will convert the starch in six times its weight of grain into maltose ready for fermentation. Practically all the alcohol produced in this country, except that from molasses, is made from sugar produced by malt.

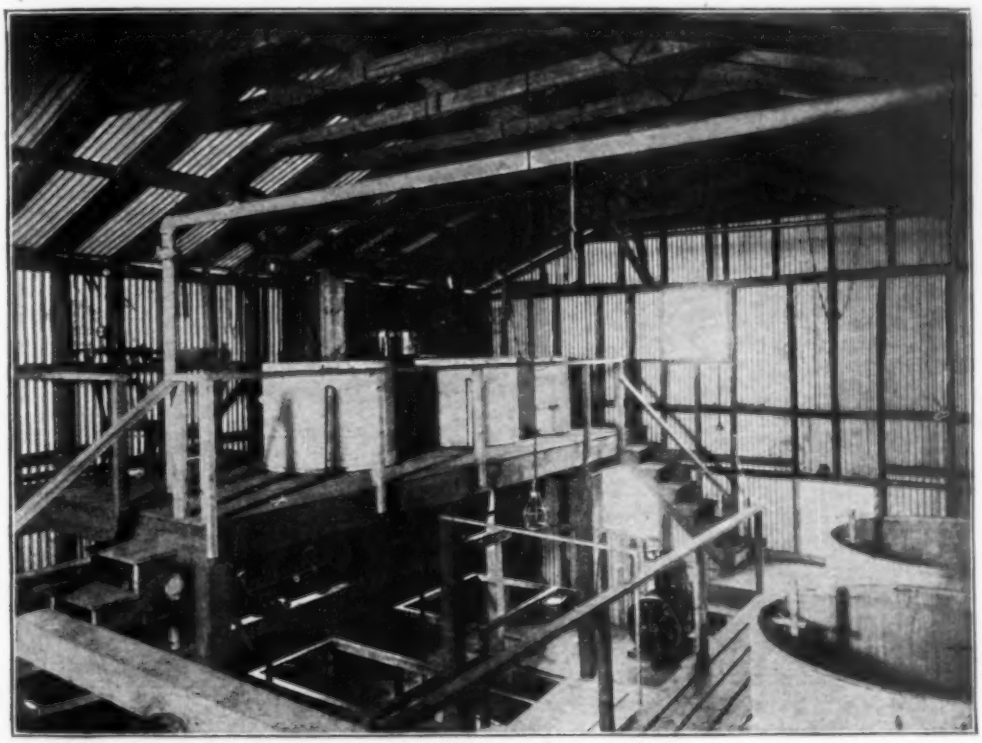


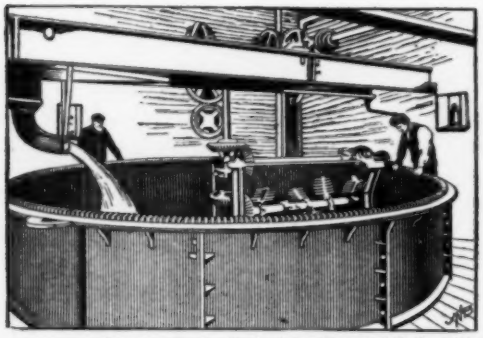
Fig. 2—Tubs for Yeast Making

Yeast. The yeast plant is a low order of vegetation, which grows practically everywhere where vegetation is found. These wild yeasts are very abundant in regions where grapes and other fruits are found, and produce in the expressed juice of these fruits the natural fermentation which makes cider, wine and perry. The yeast cell is easily seen by means of a small magnifying glass, and one of its forms is shown in Fig 1.

The yeast cells as such do not produce the fermentation, but they secrete a diastase which acts on the molecules of sugar and breaks them up principally into alcohol and carbon dioxide.

Growth of Yeast. In large distilleries dependence can not be placed on the wild yeast, and the required quantity must be produced by cultivation. Making the yeast is thus one of the most important parts of the distilling industry. The character and activity of the yeast are largely instrumental in determining the quality and quantity of the product. The yeast cells reproduce themselves by budding or sprout-

ing and also, under less favorable conditions by the development of spores. A pure culture of yeast, that is, a culture in which there is just one kind of



Courtesy U. S. Dept. Agr., Farmers' Bul. 268.
Fig. 4—Open Mash Tub

yeast present, is generally to be preferred to a mixture of varieties. Yeasts are much like human beings. When different races are brought together much of the energy developed is consumed in fighting for supremacy.

Yeast Food. The medium in which the yeast is grown usually consists of a mash containing equal parts of rye meal and barley malt. Small portions of other grains are sometimes used, but not in quantities sufficient to change materially the nutritive medium. A proper amount of water is heated to 140°-150° F. The rye meal is added and well stirred and then the malt, reducing the temperature to about 120° F. The stirring is continued and the mixture slowly heated until the temperature reaches about 140° F. A higher temperature is apt to impair the diastatic activity of the malt and thus interfere with converting the starch of the rye meal into sugar. The mixture is next made sour by the action of a lactic acid ferment which usually requires about 24 hours. After souring, the temperature is raised to 160°-170° F., to destroy any remaining yeasts or bacteria and secure a medium suitable for seeding by a pure culture. The mash is cooled to about 85° F., which is the best temperature to add the yeast culture. After adding the pure seed yeast, the mixture is cooled to about 60° F. As the yeasts begin to proliferate the temperature rises, but it should not be allowed to go above 85° F. The yeast rises with the bubbles produced by the fermentation and is scraped off as a beautiful creamy covering of the fermenting mass. The alcohol which is produced during the process is secured by distillation in a manner described in the next paper.

Fermentation. The process of fermentation is properly divided into three processes—a, mashing; b, saccharification, and c, fermentation. The process of mashing is preceded by the appropriate mechanical treatment necessary to reduce the substance containing the starch or sugar to a proper state of physical comminution. Cereals are reduced to meal or flour by grinding between stones or on a roller mill.

There is no sifting or separation of the ground products, but the meal of the whole grain in weighed quantities is carried to the mash tub. Potatoes, melons, and fruits are reduced to a fine pulp by an appropriate rasping machine of which a cider mill is a type. Potatoes are pulped in a machine similar to that employed in making potato starch. The best results are obtained by having enough water in the material to make a mash with from 12 to 20 per cent of fermentable material, but smaller quantities may be handled with profit. In the case of melons and fruits and other waste products, the total quantity of fermentable matter in the material used may not exceed 8 to 10 per cent, and in such cases, unless the material can be obtained practically without cost, the manufacture will not prove profitable.

Mash Tub. The mash tub may be open or closed. In an open tub the temperature of mashing cannot very greatly exceed the boiling point of water and such tubs are used chiefly in making beverages.

Industrial alcohol is more economically made in a closed tub which permits the emulsifying of the starch at a high temperature, thus securing a higher yield.

The mashing takes place in a closed vessel, shaped usually like a longitu-

dinal steam boiler, and at a high pressure, viz., from 40 to 80 lb. steam pressure. A stirring apparatus driven by appropriate machinery keeps the mass in motion and thus secures uniform emulsifying. After the starch paste has been made as thin as possible by the action of the steam and water under pressure, the steam is cut off, and the contents of the mash tub cooled, usually by the operation of a vacuum pump, to about 140° F. At this point the malt is added and the thin starch paste is rapidly converted into sugar.

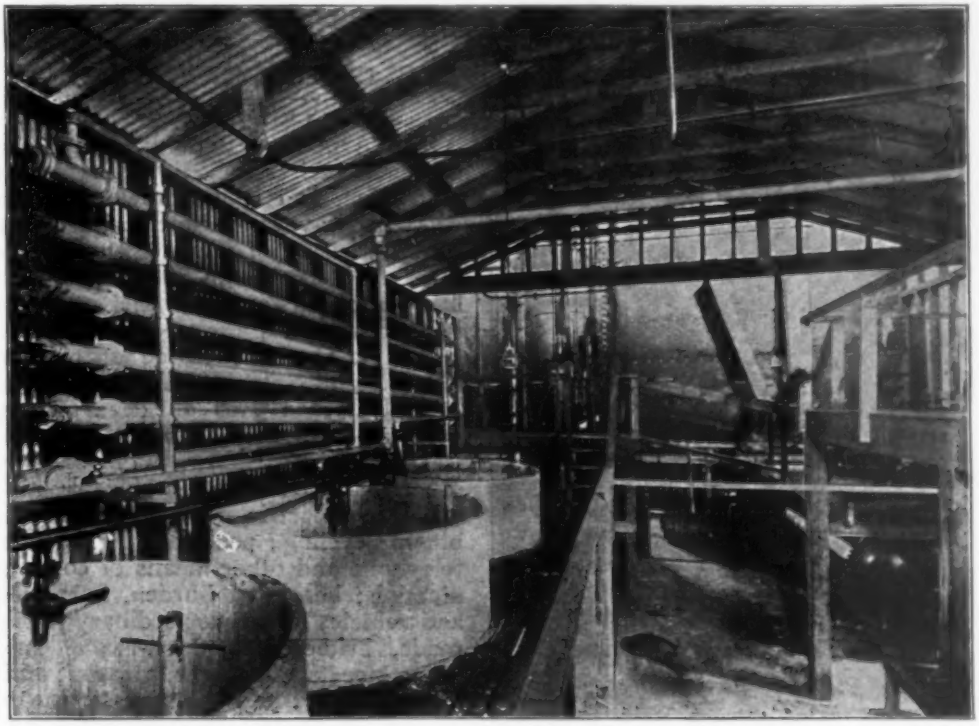


Fig. 6—Cooling Apparatus and Fermenting Vats of a Small Distillery

Fermentation. The warm sugar solution is cooled to about 70° F. by passing through tubes surrounded by cold water and conducted into the fermentation vats. The yeast, prepared as already described, is added. The fermentation begins in a few hours, if all conditions are favorable, and reaches its maximum activity in about 24 hours. By this time, the temperature has risen considerably and the whole mass appears to be in violent ebulition, due to escape of the carbon dioxide produced by the fermentation. A fermenting vat at its full activity is a striking illustration of the power of natural chemical processes.

The method of producing alcohol has been described somewhat in detail because there is an erroneous idea entertained by many that any one may easily make alcohol for industrial purposes. Many farmers have been imbued with the idea that by the outlay of a few hundred dollars a farm distillery could be erected and operated at a profit. This brief study of the technique which has been presented shows how erroneous this notion is. The production of alcohol is an art that has to be studied and mastered. It is as intricate as milling or tanning, and even more so, and can only be successfully conducted by those who have had experience in its various processes. The day will doubtless come when alco-

hol experts will be found among American farmers, as they are to-day among the farmers of Germany and France. But that day has not yet arrived, and we cannot expect to see agricultural stills spring up in this country by the hundreds and thousands until the agricultural colleges and experiment stations train young men in this trade.

NEWSPAPER WIRELESS STATION

One of the first wireless stations installed for the exclusive use of a newspaper in the East, and the first in Boston, is now part of the news-gathering machinery of the Boston Herald. The illustration shows the operating room. It will be used extensively in receiving news from sea, and from inland regions when such conditions exist as made it almost impossible to send news out of Washington by telegraph lines during the inauguration.

Newspaper's Wireless Operating Room

In cutting glass for spectacles and other optical purposes, a Paris concern refrigerates the glass to keep it from chipping.

THE COMING EXHIBITION AT BUENOS AIRES

The Argentine Republic is to hold at Buenos Aires in 1910 its first great exhibition, and it is noteworthy that this, its way of commemorating the first centenary of its independence, is to be mechanical—an international exhibition of railways and other means of land transport.

The exhibition will be opened on May 25, and close Nov. 25, and the exhibits, divided into 16 departments, will comprise the following subjects: Railways and tramways moved by other than electric power; electric railways and electric tramways; automobilism; cycling; postoffices, telegraph, telephone and other means of communication; beasts of burden, horsemen and vehicles for teams; ordinary public roads, bridle-roads, high-roads, suburban streets and sporting tracks; military transport and sanitary service in the transport of sick and wounded; baggage, packing, etc.; municipal transports and vehicles, apparatus etc., pertaining to the fire service; decorative fine arts applied to the transport industry; hygiene and sanitation in land transports; insurance, assistance and pensions of workmen, employes, agents, clerks, etc., in the service of transport companies; galleries for the exhibition of national mechanical industries applied to transports and galleries showing manufacturing in full action; special national works, and aeronautical experiments.

From the above list of exhibits and subjects it is obvious that it will be a great demonstration of improvements effected in the means and methods of land transportation, all of which can be adapted to the Argentine Republic in connection with the exportation of its innumerable products. The principal railway companies all over the world,

as well as the manufacturers of other means of transportation, are greatly interested in the success of the undertaking. The country is ready and anxious to accept the best and will adopt it on a large scale without prejudice. No one is invited as a rival, for local industries have not yet reached a sufficient stage of development, but a splendid market will be open to all latest improvements. Mechanically, South America is just awakening.

The exhibition committee, headed by Alberto Schneidewind as president, and Juan Pelleschi as chief commissioner, have sent out complete matter concerning the exhibition in Spanish, English, French and German.

Exhibitors desirous of sending engines or other objects requiring foundations or special buildings, the use of water, gas, steam or electric power, as well as those who wish to show engines in motion or some manufacturing process in operation, should apply immediately. Goods will be admitted to the premises of the exhibition from April 1 until May 5. Heavy or bulky packages, such as engines, and appliances requiring special foundations or erecting, must be consigned not later than Feb. 28.

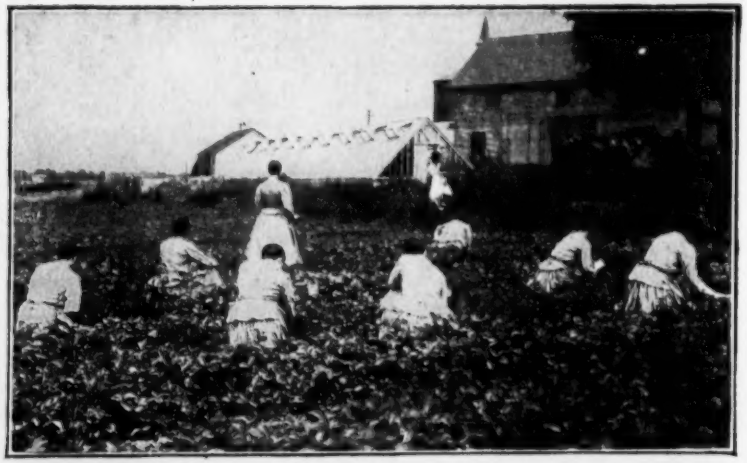
MASSACHUSETTS REFORMATORY PRISON FOR WOMEN

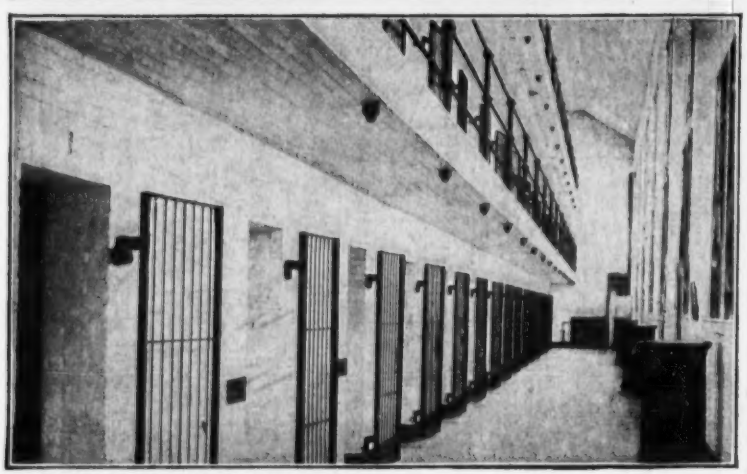
One of the most unique institutions in the world, and said to be the only prison of its kind in the world, is the Massachusetts reformatory prison for women at South Framingham, Mass. Here some 400 women are prisoners at the present time, sent there for various offences, a few of them serious, but the majority of them offences against public order. The prison is a correctional institution, the aim being to reform the women, teach them a useful occupation, restore them to health and mental vigor, and to give them at least the rudiments of a school education. When they come out they are strong and healthy and ready to take up a new life.

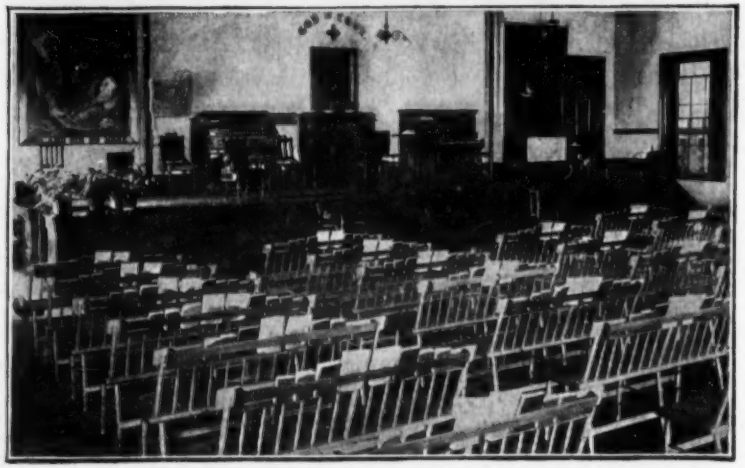
One of the principal trades taught is shirtmaking, and the institution has a large factory devoted to this work,

Copyright, 1909, by Atlantic News Service
Bakery—Reception Room—Laundry

with electric power machines. There is also a laundry for the prison, where the strongest of the girls are taught to use various laundry machines; a kitchen and bakery; a garden in which







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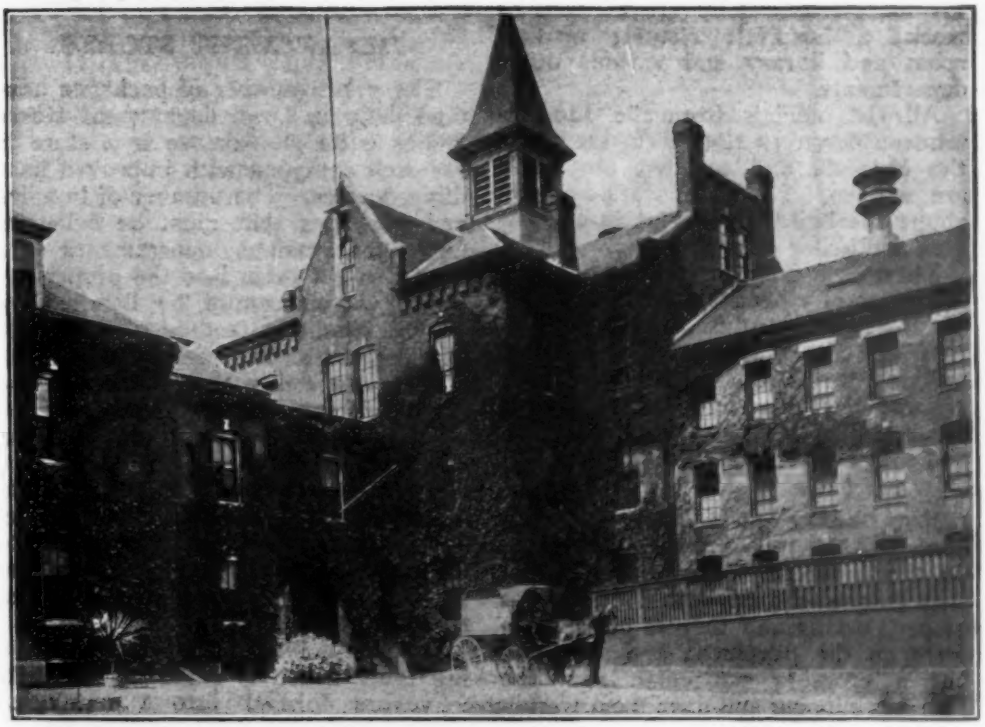
School Room—Tier of Cells

Picking Strawberries—Chapel



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Entrance to Reformatory—Dining Hall, Seats 400—Shirt Factory

the most trustworthy are allowed to work; a hospital; chapel; reading room and library and various other departments.

All the officials from the superintendent down to the clerk, including the chaplain and resident physician, are women. No men are employed about the buildings except in the engine and boiler rooms.

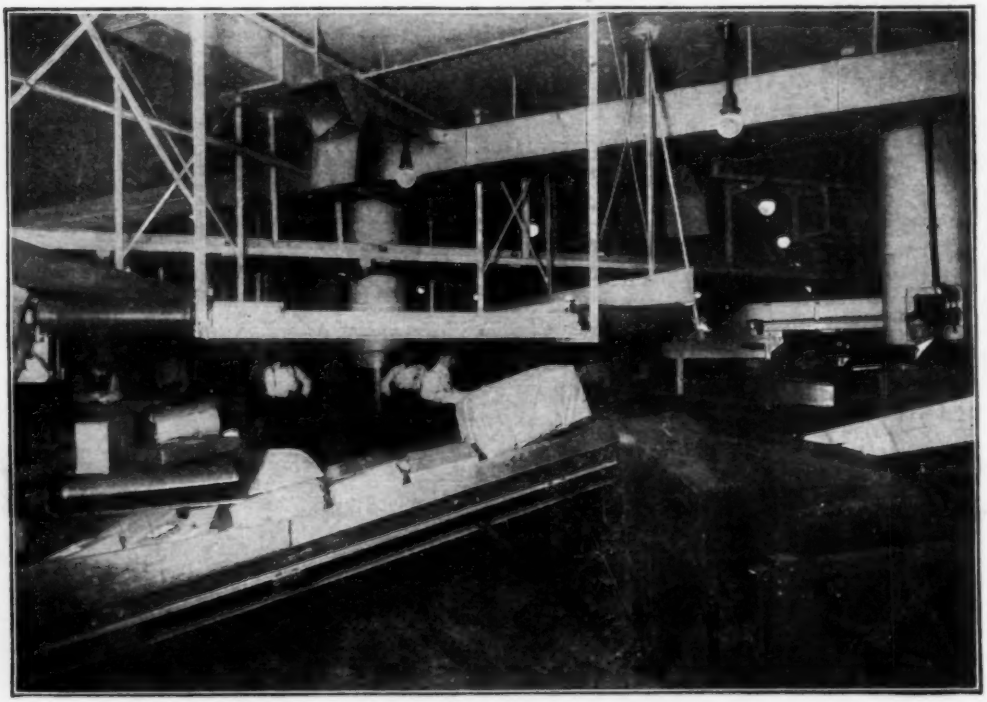
There is a farm of about 275 acres, in charge of a head farmer, who takes his orders from the woman superintendent. He, of course, has only men working under him, but they are not allowed near the prison, and do not live near it. They are boarded outside, and some of them are married.

Five heavy steel girders, being hauled to the top of a new skyscraper on State street, Chicago, fell when they reached the eleventh floor. Scores of pedestrians and drivers of vehicles were on the pavement and sidewalk, but a crossing policeman saw the girders slipping and gave them warning.

PACKAGE CONVEYORS FOR DEPARTMENT STORES

The great number of packages handled daily in large department stores makes quite an expense if a store is not well equipped with improved handling devices. The number of bundles and packages that must be collected from the various departments and sorted to get them into the proper delivery wagon cannot be handled by the old primitive method of push cars and baskets, as the expense of the employees for doing this work and the amount of space required would be out of the question. The accompanying illustrations show the installation of belt conveyors in a large department store where 19 of them are in use. These conveyors are placed in the subbasement and the packages from the various floors are delivered to them through spiral chutes.

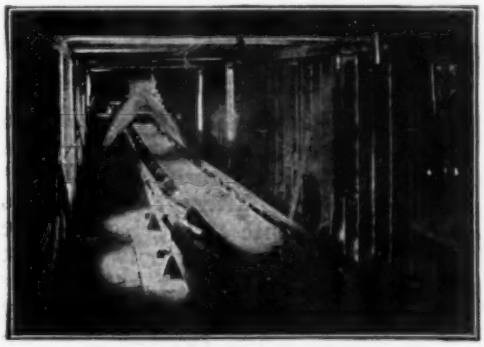
One of the illustrations shows a sorting table which is made of four belt conveyors formed into a rectangle.



Sorting Table in Department Store System

This table receives the packages from the chutes and carries them continuously around the rectangle. The packages are then handled by boys located inside of this moving rectangular table, who take off the bundles, read the directions or destinations on each package, and throw them on the proper conveyor above which carries them to the shipping table designated for the different sections of the city. They are then loaded into the wagons or trucks to be delivered.

The belts are made of 3-ply canvas duck, 30 in. wide, cemented together with rubber friction and an outside rubber cover. The belts travel on troughing idlers consisting of one long 3-in. tube through the center and two small pulleys on each end, which stand



One of the Belt Conveyors

at an angle and cause the belt to trough. There are some 3,000 ft. of belt used in the installation, of which parts are shown in the illustrations.

"REFRIGERATED" WINDOW DISPLAY

A dealer in provisions, fish and groceries in Spokane, Wash., has set up what he calls a refrigerated window display, with the result that nearly every person who passes the store lingers to watch it. The foods and delicacies thus displayed are frequently changed, but the gracefully curved pipe, with nearly 4 in. of frost adhering to it, is the chief feature.

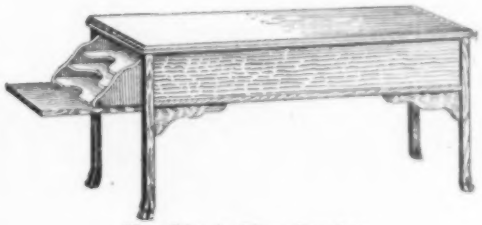
In addition to the 42 ft. of window space, the 2½-ton refrigerating machine serves three 12- by 12-ft. rooms, one 8- by 10-ft. room, and three cases

Refrigerating a Window Display

having a total length of 24 ft. About 800 ft. of pipe makes possible the proper refrigeration of the whole store, instead of just the one freezing room the majority of such concerns have. For this, an additional 100 lb. of ammonia for the year and $12 worth of water per month are required. The machine is driven by a 7½-hp. electric motor, and the current costs about $40 per month for constant use, day and night.

COMBINATION PIANO BENCH AND MUSIC CABINET

A piano bench for one or two players and a music cabinet combined is shown in this illustration. It is a neat, artistic bench with the music cabinet arranged at one end in such a manner that the dropping of the panel draws the music shelves outward to make the music sheets easily accessible. The other end of the bench can be arranged

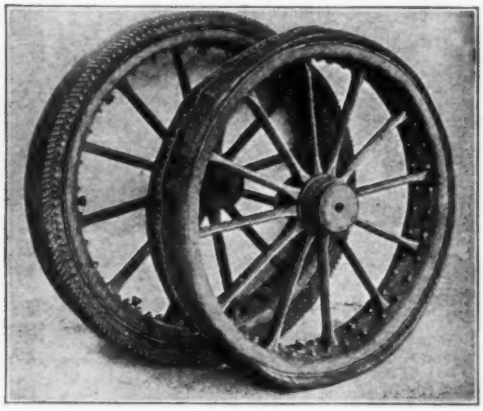


New Idea in Piano Benches

for piano-player rolls, if the bench is to be used in connection with such an instrument.

THE FIRST PNEUMATIC TIRES

Among the collection of historical automobiles and accessories recently exhibited in London, two of the most

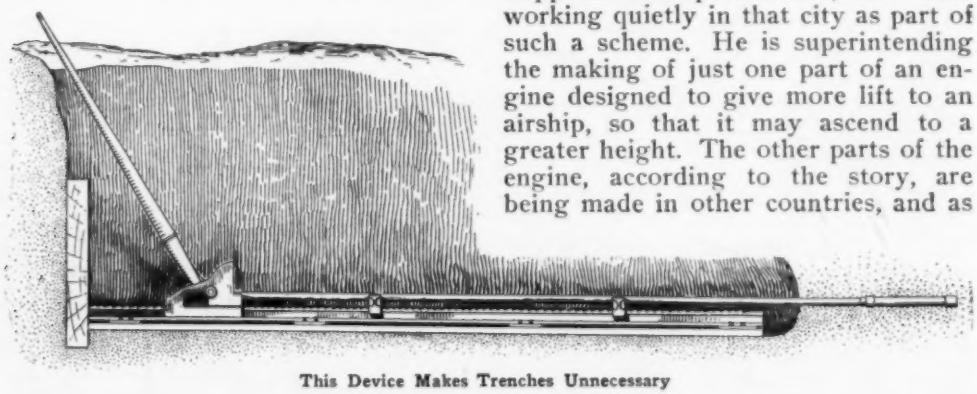


Pneumatic Tires of 60 Years Ago

interesting relics were these pneumatic tires, the first ever made. They were the work of Robert W. Thompson in 1845 or 1846, and were originally fitted to a horse-drawn vehicle.

JACK FORCES PIPE THROUGH GROUND

A jack that is of great value in laying lines of small pipe under cement sidewalks, lawns, railway tracks, or pavements, without disturbing the surface, has been placed on the market



This Device Makes Trenches Unnecessary

by a manufacturing concern. As shown in the illustration, all that is required is a ditch long enough to take the jack and start the first length of pipe. It is capable of driving pipe up to 4 in. in diameter, and as great a length as 280 ft. of 2½-in. pipe has been forced through the ground by it. The jack consists of a cage which travels on a rack and is moved by a socket lever and pawls. At the front of the cage is a groove and clamps for holding the pipe. The rack has machine-cut teeth, and is provided with bolts by which it is secured to a stout plank. It also carries guides for holding the pipe in line. When the ground contains roots or other materials difficult to penetrate, a hardened coupling turned to a cutting edge is screwed onto the forward piece of 2 or 3-ft. pipe which is designated as the pilot. This pilot is one size larger than the line to be laid.

EXTRAORDINARY SECRECY BY ZEPPELIN

Instances have been known in which different parts of a machine have been made in different factories by different workmen in the attempt to keep its nature an absolute secret, but to have these parts made in not only different factories and cities, but in different countries as well, seems exceptionally extraordinary. Yet according to reports from Detroit, a young German mechanic, who is in the employ of the Zeppelin airship interests, has been working quietly in that city as part of such a scheme. He is superintending the making of just one part of an engine designed to give more lift to an airship, so that it may ascend to a greater height. The other parts of the engine, according to the story, are being made in other countries, and as soon as each part is completed it will be sent to the Zeppelin headquarters in Germany.

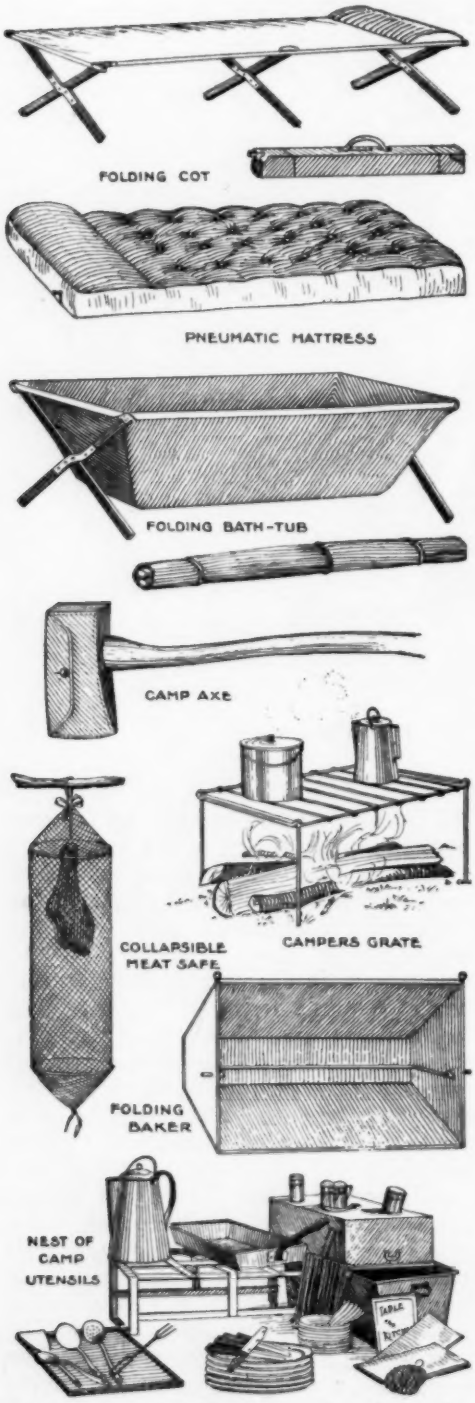
AUTOMOBILE CAMPING OUTFITS

The first thing to be considered in selecting a camping outfit for automobile trips is bulk; the second, the maximum of usefulness of each article. Any equipment designed for ordinary camping trips would be suitable for automobile camping trips, were it not for the matter of weight and bulk, but as bulk must be brought down to the minimum, especially designed outfits must be acquired, and of such outfits the accompanying illustrations give an excellent example.

OUTFIT FOR TWO PERSONS

One automobile accessory concern furnishes an outfit suitable for two persons which is carried complete in a chest 30 in. long, 10 in. wide, and 12 in. deep. It includes a waterproof silk pyramid tent, size 6 by 7½ ft., furnished with a one-joint pole, one set of iron tent pins, and a ground cloth which is water-proof and sewn in tent; 2 all-wool gray blankets; a complete aluminum cooking set, consisting of one cooking pot holding 7 pt., one cooking pot holding 10 pt., a frying pan, coffee pot, 2 plates, 2 soup bowls, 2 dessert spoons, knives, forks, cups, and teaspoons; an alcohol stove, 2 steel folding stools, a folding pail, and a folding water bottle. The chest is of the telescopic type and can be fastened to the running-board of the machine.

Among the many camping accessories offered by different concerns are, pneumatic mattresses that fold up when not in use; folding cots that weigh but 12 lb. and occupy storage space of but 3 ft. by 6 in.; axes with leather sheath and loop to be carried at the belt; folding bathtubs that are 5 ft. long, 27 in. wide, and 16 in. deep when extended, and but 5 ft. long by 5 in. square when nested; steel camp grates that fold up, weighing but 2½ lb.; collapsible meat safes, which can be suspended from a tree or the top of a tent, and weigh but 8 oz.; medicine chests which weigh but 11 oz., yet contain such articles and remedies as are likely to be required; cooking kits that weigh 15 lb. and contain, besides a fire jack, a complete outfit of cooking and serving utensils for 6 persons; oil stoves that are complete in a small tin case, and folding aluminum bakers that



are 16 by 18 by 10 in. in size when extended, but fold flat and are carried in a case when not in use.

BRONZE HORSE OF COLOSSAL SIZE

A colossal bronze horse which will carry as huge—proportionately—a cast of Victor Emmanuel II, of Italy, as part of the gigantic memorial statue now set up in Rome to honor him, is probably the largest ever cast. The trappings of the horse alone weigh more than 4 tons, while the pistol holsters are higher than an ordinary man. The breast of the horse weighs 7 tons, and the abdomen nearly 9 tons. The sabre which will hang at the King's side is over 13 ft. long. More than 30 persons can be easily accommodated inside the horse, and one of the illustrations shows 16 gathered around a banquet table within it.

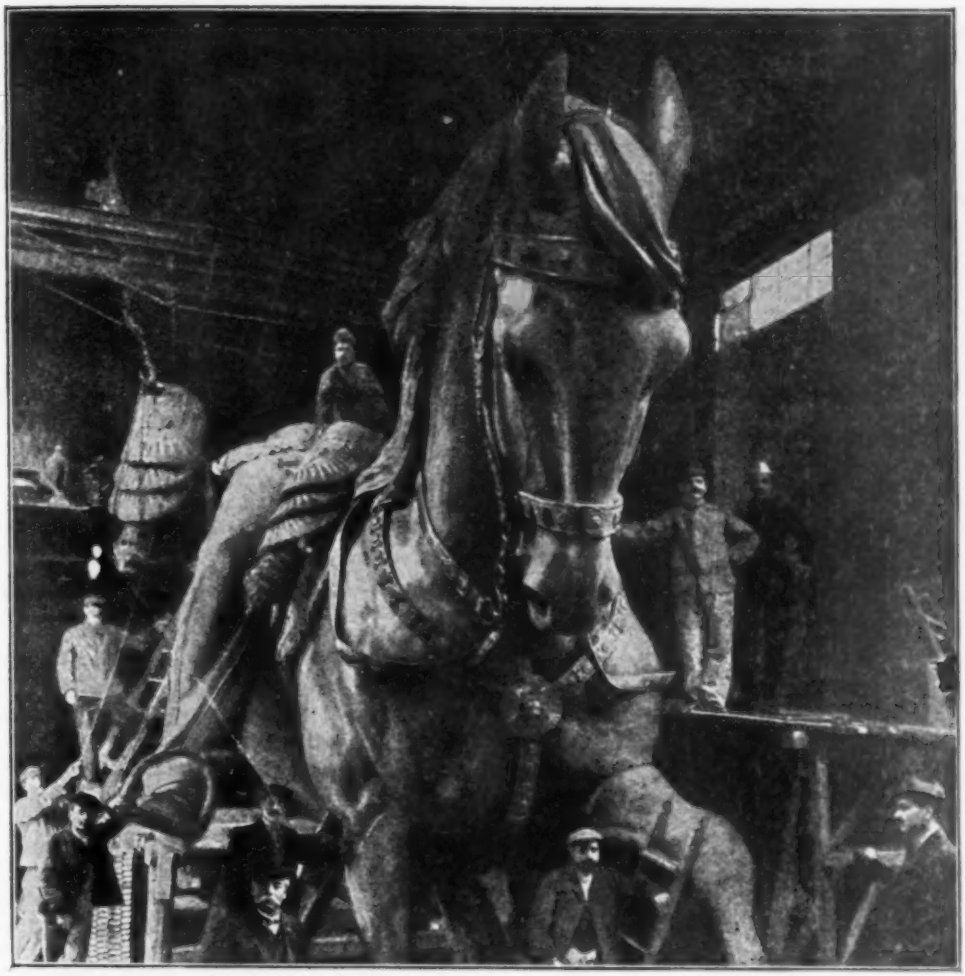
HISTORY OF WIRELESS AS A LIFE-SAVER

Counting the lives saved from the trans-Atlantic liners "Republic" and "Slavonia," and two smaller vessels, nearly 3,000 persons can attribute their quick rescue from peril to the work of wireless telegraphy, an extraordinarily satisfactory record for a source of aid still in its infancy.

Today, after but a short period of successful operation, the system is now so general on Atlantic vessels that it is practically impossible for a ship to be completely isolated. She can always speak to one or more ships, so that, unless she founders instantly, a signal for assistance will bring relief.

In the instance of the "Slavonia," which ran on the rocks off Flores Island in the Azores, both the "Batavia" and the "Princess Irene" heard the calls for assistance. The former was 140 miles distant, and the latter 158 miles. The stirring wireless drama in this instance and of that of the "Republic" are too well known to need repetition.

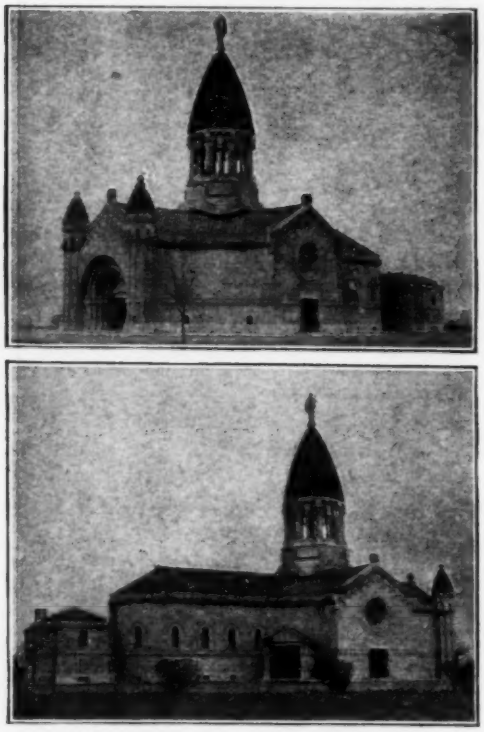
A standard bearer mounted on a motorcycle preceded King Edward's automobile at the recent Aldershot maneuvers.



Largest Horse Ever Cast in Bronze—Its Interior Used as a Banquet Hall

MOST REMARKABLE MORTUARY CHAPEL IN AMERICA

A modern reconstruction of the ancient catacombs of Rome may be seen



In Calvary Cemetery, Long Island City, N. Y.

in the new mortuary chapel recently completed in Calvary cemetery, Long Island City, New York. Calvary, the chief Catholic burial ground of Greater New York, has over 760,000 interments, a greater population than any other city of the dead in America, and its new chapel, the only one of the kind in this country, has several features which make it unique in construction and design. The structure was under way for three years, and cost $180,000. The building proper cost $130,000 and the sculpture and furnishings another $50,000. The design is the work of Architect Raymond F. Almirall, of Brooklyn, who made an exhaustive study of the old Italian churches and the mortuary chapels connected with them. The architecture is Romanesque, but modernized by the use of reinforced concrete, and the catacombs were directly inspired by the famous catacombs of Rome. The exterior is of rubble masonry, with Indiana limestone facing. On the dome, 80 ft. from the ground, is poised a statue of Christ blessing the world. It is carved from a single block of limestone, in strong, rugged lines to give good effects in the distant view from below.

From the architect's point of view, the most unusual feature is the method of construction of the dome and the groined vault on which it rests, both of which are regarded by experts as feats in reinforced concrete construction. The dome is 40 ft. across and the height from the floor to the lantern is 38 ft. It rises 50 ft. higher from that point and its total weight is 360 tons. The vault has eight penetrations, four large and four small, and both the lining of golden yellow brick and the pink Minnesota sandstone trimmings are held in place simply by adhesion to the concrete. In order to build this dome, it was necessary to build a falsework with all the accuracy of a mould, so that the brick could be laid against the forms, and the concrete with its steel reinforcement placed in the moulds. When the concrete had set, the falsework was removed, and the great dome stood as an imposing architectural crown to the structure, as well as a feat in construction.

The crypts or catacombs are for the burial of the priests of the diocese of New York, under the charge of which the cemetery is maintained. At present, but one section of the catacombs has been completed with accommodations for twenty-four bodies in the concrete niches. But the section can be extended underground in four directions, and at any time an addition for seventy-two more bodies can be made. For a cryptal burial there is a lift set into the floor of the chapel to lower the body to the level of the crypts.

The record of burials at Calvary indicates that the mortuary chapel will be in almost constant use. The burials

average seventy a day and often run as high as one hundred and twenty. The structure is consequently designed so that one funeral party can depart to the burial plot without interfering with the next cortège waiting in front of the chapel.

TYPEWRITER TELEGRAPH OBVIATES USE OF MORSE ALPHABET

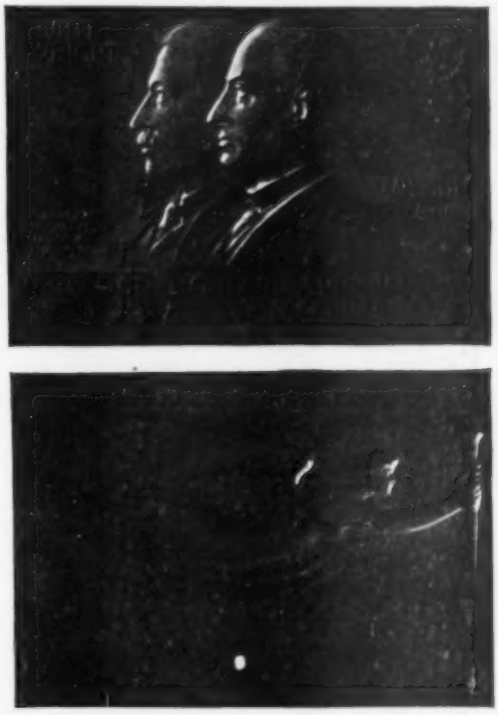
The Western Union Telegraph Company has developed a comparatively simple typewriter-telegraph instrument adapted to handle short-distance messages over circuits at present operated by means of the Morse code. It is now in use on the lines between New York and Newark, a distance of 9 miles, and messages are being sent at the rate of 40 words a minute.

No punching of paper is required, as in other machines of the kind. The sending operator sits before a keyboard like that of a typewriter, and strikes the letters and figures in the same way that a stenographer does. This actuates the corresponding type bars of the machine at the receiving station, automatically printing the message, letter for letter, on the telegraph blanks. Any business office which sends many telegrams can now connect itself to a telegraph office and have its own stenographers send the telegrams direct.

THE NATION'S HONOR TO THE WRIGHTS

Because the first successful public flights of the Wright aeroplane, with the exception of the few flights made by Orville Wright at Fort Myer last year before his accident, were made in Europe, European powers were the first to have the opportunity of showering honors upon the inventors and European kings and presidents to personally congratulate them.

America, however, has now had her opportunity to personally express her admiration. On June 10 the brothers were received at the White House and President Taft conferred upon them the medals of the Aero club. On



Medal Presented by the United States Government

June 18 the nation's medal was presented to them at Dayton, Ohio. The obverse side has a profile of the Wrights, side by side, their names, the coat of arms of the United States and the words: "In recognition and appreciation of their ability, courage, and success in navigating the air." The reverse side bears an allegorical figure carrying a flaming torch and flying through the clouds above the surface of the earth. Above is a phrase from the Bible, "Shall mount up with wings as eagles."

The state of Ohio and the city of Dayton also presented medals to the brothers.

When an automobile is loaded, a properly inflated tire should flatten about 2/5 in., but never more than 3/5 in. under any circumstance.

TIME AND ITS MEASUREMENT

By James Arthur

PART II

The ancient methods of dividing day and night in China and Japan become more hazy as we go backwards and the complications grow. The three circles in Fig. 1 (Chapter 1) are all taken from Japanese clocks, but the interpretation has been obtained from Chinese and Japanese scholars. The Japanese obtained a great deal from the Chinese, in fact nearly everything relating to the ancient methods of time keeping and the compiling of calendars. I have not been able to find any Chinese clocks constructed of wheels and pinions, but have a number of Japanese. These have a distinct resemblance to the earlier Dutch movements, and while made in Japan, they are practically Dutch, so far as the "works" are concerned, but it is easy to see from the illustrations that they are very Japanese in style and ornamentation.

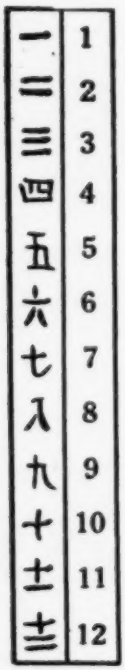


Fig. 11

introduced modern mathematics and clocks from about 1590 A. D. The ancient mathematics of Japan came largely from China through Corea. In Fig. 11 are given the Japanese figures beside ours, for the reader's use as a key. The complete day in Japan was divided into twice six hours; that is, six for daylight and six for night, and the clocks are set, as the days vary in length, so that six o'clock is sunrise and sunset. The hour numerals on Fig. 12 are on little plates which are movable, and are shown set for a long day and a short night.

In Fig. 13 they are set for short days and long nights. The narrow plates shown in solid black are the half-hour marks. In this type the hand is stationary and always points straight upward. The dial rotates, as per arrow, once in a full day. This style of dial is shown on complete clocks, Fig. 14 being a weight clock and Fig. 15 a spring clock with chain and fusee. The hours are 9 to 4 and the dials rotate to make them read backwards. The six hours of daylight are 6, 5, 4, 9, 8, 7, 6 and the same for night, so these hours average twice as long as ours. Note that nine is mid-day and mid-night, and as these do not change

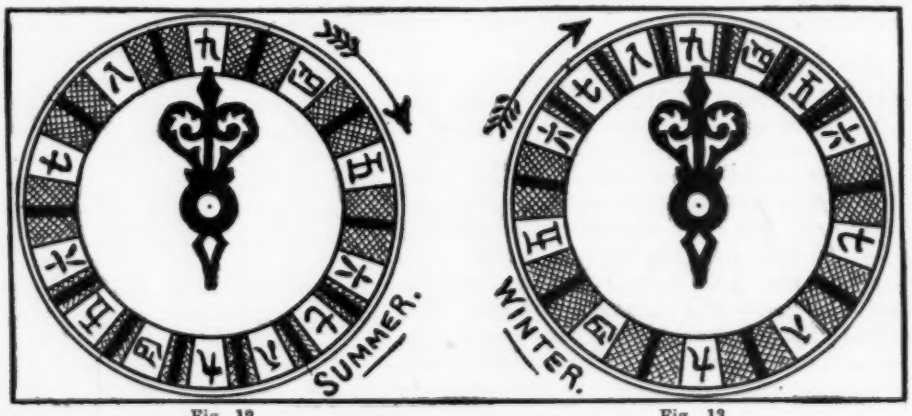


Fig. 12 Fig. 13.

Japanese Dials Set for Long and Short Days

The Dutch were the leaders in opening Japan to the European nations and

by long and short days they are stationary on the dial, as you can easily

see by comparing Figs. 12 and 13, which are the same dial set for different seasons. Between these extremes the dial hours are set as often as the owner wishes; so if he happens to correspond with our "time crank" he will set them often and dispute with his neighbors about the time. Figure 16 shows a clock with the hour numerals on a vertical series of movable plates and it is set for uniform hours when day and night are equal at the equinox. The ornamental pointer is fastened to the weight through the vertical slit, plainly visible in illustration, and indicates the time as it descends. This clock is wound up at sunset, so the six on the top of the dial is sunset the same as the six on the bottom. Figure 17 shows how this type of dial is set for long and short days and explains itself, but will become plainer as we proceed. This dial is virtually a continuation of the old method of marking time by the downward motion of the water in the clepsydras and will be noticed later.

Figure 18 represents a clock which is a work of art and shows great refinement of design in providing for the varying lengths of days. The bar

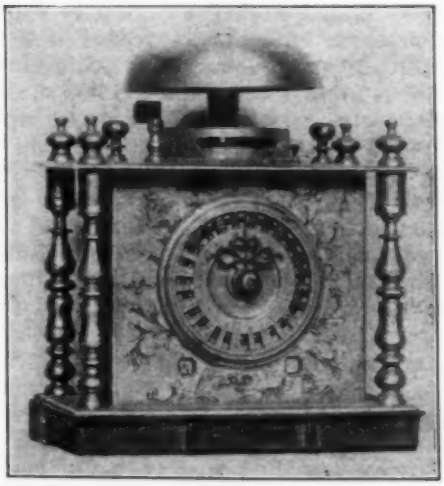


Fig. 15—Japanese Striking Clock with Spring, Fusee and Balance

lying across the dial is fastened to the weight through the two slits running the whole length of the dial. On this cross bar is a small pointer, which is

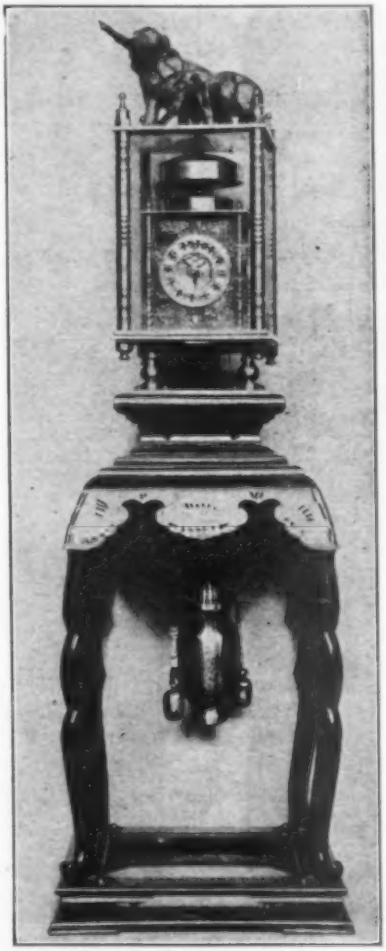


Fig. 14—Japanese Striking Clock with Weight and Short Pendulum

movable by the fingers, and may be set to any one of the thirteen vertical lines. The numerous characters on the top space of dial indicate the dates on which the pointer is to be set. This clock is wound up at sunset, and it is easy to see that as the little pointer is set towards the right, the night hours at the top of the dial become shorter and the day hours longer on the lower part. The left edge of the dial gives the hours, reading downwards, and as the pointer touches any one of the curved lines the hour is

read at the left-hand end. The curved lines formed of dots are the half-hours.

Fig. 16—Japanese Clock with Vertical Dial, Weight and Balance.

Fig. 18—Japanese Clock with Vertical Dial Having Curved Lines, Weight and Balance.

The right-hand edge of the dial has the "twelve horary characters" which will be explained later. For dividing the varying days into six hours' sunshine it would be difficult to think of a more artistic and beautiful invention than this. It is a fine example of great ingenuity and constant trouble to operate a system which is fundamentally wrong according to our method of uniform hours at all seasons. Clocks having these curved lines for the varying lengths of days—and we shall find them on circular dials as we go on—must be made for a certain latitude, since the days vary more and more as you go farther from the equator. This will become plain when you are reminded that a Japanese clock at the equator would not need any adjustment of hour numerals, because the days and nights are equal there all the year. So after such infinite pains in forming these curved lines the clock is only good in the latitude for which it was made and must not be carried north or south! Our clocks are correct from pole to pole, but all clocks must be set to local time if they are carried east or west. As this is a rather fascinating phase of the subject it might be worth pointing out that if you go north till you have the sun up for a month in the middle of summer—and there are people living as far up as that—the Japanese system would become absurd and break down; so there is no danger of any of our polar expeditions carrying Japanese clocks.

Figure 19 shows a very fine clock in which the dial is stationary and the hand moves just as on our dials. This hour hand corresponds to the single hand of the old Dutch clocks. When the Japanese reached the point of considering the application of minute and second hands to their clocks they found that these refinements would not fit their old method and they were compelled to lay aside their clocks and take ours. On this dial, Fig. 19, nine is noon, as usual, and is on top side of dial. Hand points to three quarters past *seven*, that is, a quarter to *six*, near sunset. Between the bell and the top of the clock body two horizontal balances, having small weights hung on them, are plainly shown, and the clock has two verge escapements—one connected with each balance, or "foliot." Let us suppose a long day coming to a close at sunset, just as the hand indicates. The upper balance, which is the slow one, has been swinging backwards and forwards measuring the long hours of the day. When the clock strikes six, at sunset, the top balance is thrown out of action and the lower one, which is the fast one,

is thrown into action and measures the short night hours. At sunrise this is thrown out and the top one in again to measure the next day's long hours. As the days vary in length, the balances, or foliots, can be made to swing faster or slower by moving the weights inwards or outwards a notch or two. The balance with small weights for regulation is the oldest known and was used in connection with the verge escapement, just as in this clock, by the Dutch about 1364. All the evidence I can find indicates that the Japanese clocks are later than this date. In design, ornamentation and methods for marking varying days, however, the Japanese have shown great artistic taste and inventiveness. It is seen that this dial in addition to the usual six hours, twice over, has on the outside circle of dial, the "twelve horary branches" called by the Japanese the "twelve honorary branches," thus indicating the whole day of twelve Japanese hours, six of them for day and six for night. By this means they avoided repeating the same hours for day and night. When it is pointed out that these "twelve horary branches" are very old Chinese, we are not in a position to boast about our twenty-four hour system, because these branches indicate positively whether any given hour is day or night. When we print a time table in the twenty-four hour system so as to get rid of our clumsy A. M. and P. M., we are thousands of years behind the Chinese. More than that, for they got the matter right without any such pressure as our close running trains have brought to bear on us. These branches have one syllable names and the "ten celestial stems" have also one syllable names, all as shown on Fig. 20. Refer now to Fig. 21 where two disks are shown, one having the "twelve horary branches" and the other the "ten celestial stems." These disks are usually put behind the dial so that one "branch" and one "stem" can be seen at the same time through two openings. The clock moves these disks one step each night, so that a new pair shows each day. Running in this manner, step by step, you will

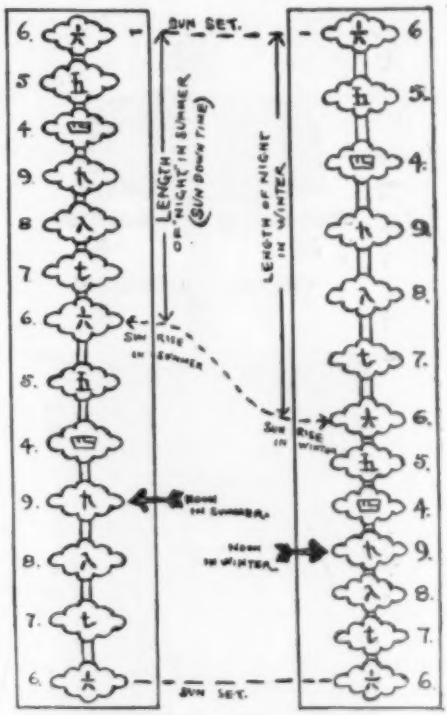


Fig. 17—Japanese Vertical Dials

find that it takes sixty moves, that is sixty days, to bring the same pair around again. Each has a single syllable name, as shown on Fig. 20, and we thus get sixty names of two syllables by reading them together to the left. The two openings may be seen in the dials of Figs. 15 and 19. So the Japanese know exactly what day it is in a period of sixty which they used in their old calendars. These were used by the Chinese over four thousand years ago as the names of a cycle of sixty years, called the "sexagenary." The present Chinese year 4606 is YU-KI which means the year 46 of the 76th "sexagenary." That is, $76 \times 60 + 46 = 4,606$. In Fig. 20, we read TSU-KIAH, or the first year. If you will make two disks like Fig. 21 and commence with TSU-KIAH and move the two together you will come to YU-KI on the 46th move. But there is another way which you might

like better, thus: Write the twelve "branches," or syllables, straight down-

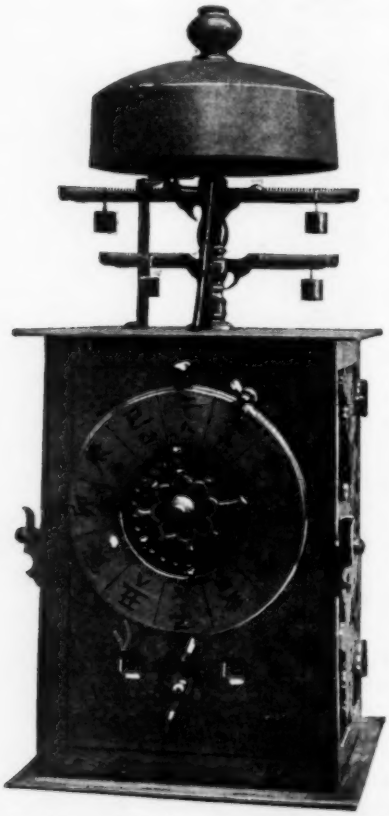


Fig. 19—Japanese Striking Clock with Two Balances and Two Escapements; Dial Stationary, Hand Moves

wards, continuously five times; close to the right, write the ten "stems" six times. Now you have sixty words of two syllables and the 46th, counting downwards, will be YU-KI. Besides, this method gives you the whole sixty names of the "sexagenary" at one view. Always read *left*, that is, pronounce the "stem" syllable first.

Calendars constitute a most interesting and bewildering part of time measuring. We feel that we have settled the matter by determining the length of the year to within a second of time, and keeping the dates correctly to the nearest day by a leap year every fourth and every fourth century, established by Pope Gregory XIII in 1582, and known as the "Gregorian Calendar." In simple words, our "almanac" is the "Gregorian." We are in the habit of saying glibly that any year divisible by four is a leap year, but this is far from correct. Any year leaving out the *even hundreds,* which is divisible by four is a leap year. *Even hundreds* are leap when divisible by four. This explains why 1900 was a common year, because *19 hundreds* is not divisible by four; 2000 will be a leap because *20 hundreds* is divisible by four; therefore 2100, 2200 and 2300 will be common years and 2400 a leap, etc., to 4000 which must be made common, to keep things straight, in spite of the fact that it is divisible by four both in its hundreds and thousands. But for practical purposes, during more than two thousand years to come, we may simplify the rule to: *Years* and *even hundreds* divisible by four are leaps. But great confusion still exists as a result of several countries holding to their own old methods. The present Chinese year has 384 days, 13 months and 13 full moons. Compared with our 1909 it begins on January 21st and will end on February 8, 1910. Last year the China-Japan calendar had 12 months, or moons, but as that is too short they must put in an extra every thirtieth month. We only allow the error to reach one day and correct it with our leap years, but they are not so particular and let the error grow till they require another "moon." The Old Testament is full of moons, and even with all our "modernity" our "feasts" and holy days are often "variable" on account of being mixed up with moons. In Japan the present year is the 42nd of Meiji, that is, the 42nd of the present Emperor's reign. The present is the Jewish 5669. These and others of varying lengths overlap our year in different degrees, so that in trade matters great confusion exists. The Chinese and Japanese publish a trade almanac in parallel columns with ours to avoid this. It is easy to say that we ought to have a uniform calendar all over the world, but the same remark applies just

as much to money, weights, measures, and even to language itself. Finally, the difficulty consists in the facts that there are not an even number of days in a year—or in a moon—or moons in a year. "These many moons" is a survival in our daily speech of this old method of measuring by moons. Just a little hint as to the amount of superstition still connected with "new moon" will be enough to make clear the fact that we are not yet quite so "enlightened" as we say we are. While our calendar, or almanac, may be considered as final, we must remember that custom and religion are so mixed up with the matter in the older countries of the East that they will change very slowly. Strictly, our "era" is arbitrary and Christian; so we must not expect nations which had some astronomical knowledge and a working calendar, thousands of years before us, to change suddenly to our "upstart" methods.

In Fig. 22 we have the dial of a very complicated astronomical clock. This old engraved brass dial did not photograph well, so I made a copy by hand to get clean lines. Commencing at the centre, there is a small disk, B, numbered from 1 to 30, giving days of the moon's age. The moon rises at A and sets at AA, later each day, of course. Her age is shown by the number she touches on disk B, as this disk advances on the moon one number each day. Her phases are shown by

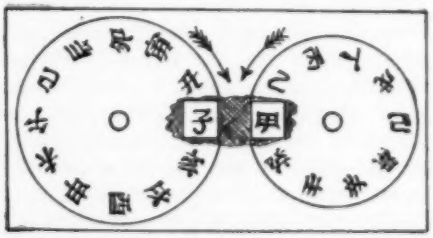


Fig. 21—"12 Horary Branches" and "10 Celestial Stems" as Used in Clocks

the motion of a black disk over her face; so we have here three motions for the moon, so differentiated as to show *phase, ascension* and *age*. Still further, as she is represented on the dial when below the horizon, it can be seen when she will rise, and "moonlight" parties may be planned. Just outside the moon's course is an annulus having Japanese numbers 1 to 12, indicating months. Note the recurring character dividing the months in halves, which means "middle," and is much used. If you will carefully read these numbers you will find a character where *one* would come; this means "beginning" or "primary" and is often used instead of one. The clock hand is the heavy arrow and sweeps the dial once in a whole day, same direction as our clocks. This circle of the months moves along with the hand, but a little faster, so as to gain one number in a month. As shown on the figure it is about one week into the sixth month. Next outward is the broad band having twelve curved lines for the hours ending outwardly in a ring divided into 100 parts, marked off in tens by dots. These curved lines are numbered with the Japanese numerals for hours which you must now be able to read easily. These hour lines, and the dotted lines for half hours, are really the same as the similar lines on Fig. 18 which you now understand. As the hand sweeps the dial daily it automatically moves outward a little each day, so it shortens the nights and lengthens the days, just as previously explained for Fig. 18. But there is one difference, for you will notice that the last night

子	TSU. 1	甲	KIAH. 1
丑	CHOU. 2	乙	YIN. 2
寅	YIN. 3	丙	PING. 3
卯	MAO. 4	丁	TING. 4
辰	SHEN. 5	戊	WU. 5
巳	SSU. 6	己	KI. 6
午	WU. 7	庚	KENG. 7
未	WEI. 8	辛	SIN. 8
申	SHEN. 9	壬	JEN. 9
酉	YU. 10	癸	KWEI. 10
戌	SUH. 11		
亥	HAI. 12		

Fig. 20—Key to "12 Horary Branches" and "10 Celestial Stems

hour, on which the arrow hand now stands, is longer than the other night hours before it, and that it is divided into *three* by the dotted lines. The last day hour, on the left of dial, is also long and divided into *three* That is, while all the dials previously described have equal hours for any given day, or night, this dial has a *last long hour* in each case, divided into three instead of the usual half-hours. This is a curious and interesting point having its origin long before clocks. In the early days of the clepsydra in China, a certain time was allowed to dip up the water from the lowest jar, each morning and evening about five o'clock of our time, see Fig. 8 (Chapter 1). During this operation the clepsydral was not marking time, and the oriental mind evidently considered it in some sense outside of the regular hours, and like many other things was retained till it appeared absurdly on the earlier clocks. This wonderful feat of putting an interval between two consecutive hours has always been impossible to modern science; yet President Roosevelt performed it easily in his "constructive" interregnum! Referring to the Canton clepsydra, Fig. 8, we find that the float, or "bamboo stick," was divided into 100 parts. At one season 60 parts for the day and 40 parts for the night, gradually being changed to the opposite for short days. The day hours were beaten on a drum and the night hours blown on a trumpet.

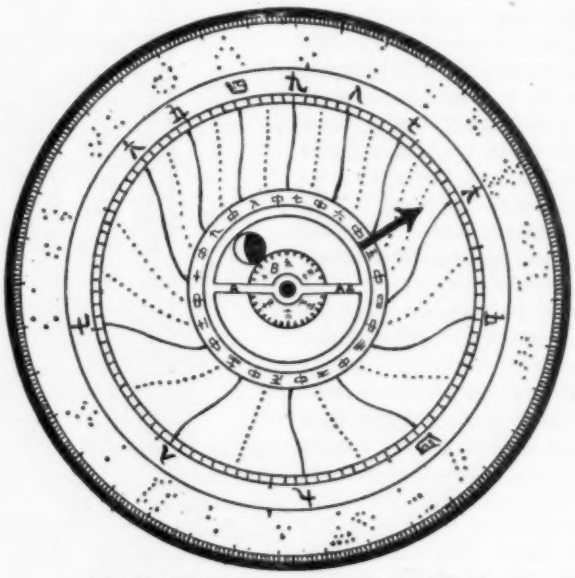


Fig. 22—Dial of Japanese Astronomical Clock

Later the hour numerals were made movable on the "bamboo stick." This is virtually a vertical dial with movable hour plates, so their idea of time measuring at that date, was of something moving up or down. This was put on the first clocks by the Japanese; so that the dial of Fig. 16 is substantially the float of the Chinese clepsydra. Further, in this "bamboo stick" of 100 parts, we have our present system of decimal numbers, so we can afford to be a little modest here too. Before leaving Fig. 22 note the band, or annulus, of stars which moves with the month circle. I cannot make these stars match our twelve signs of the Zodiac, but as I have copied them carefully the reader can try and make order out of them. The extreme outer edge of the dial is divided into 360 parts, the tens being emphasized, as in our decimal scales.

As we are getting a little tired of these complicated descriptions, let us branch off for a few remarks on some curiosities of Eastern time keeping. They evidently think of an hour as a *period of time* more specifically than we do. When we say "6 o'clock" we mean a point of time marked by the striking of the clock. We have no names for the hour periods. We must say "from 5 to 6" or "between 5 and 6" for an hour period. The "twelfth hour" of the New Testament, I understand to mean a whole hour ending at sunset; so we are dealing with an oriental attitude of mind towards time. I think we get that conception

nearly correct when we read of the "middle watch" and understand it to mean *during* the middle third of the night. Secondly, why do the Japanese use no 1, 2, 3 on their dials? These numbers were sacred in the temples and must not be profaned by use on clocks, and they mentally deducted these from the clock hours, but ultimately became accustomed to 9, 8, 7, 6, 5, 4. Thirdly, why this reading of the hours backwards? Let us suppose a toiler commencing at sunrise, or six. When he toiled one hour he felt that there was one less to come and he called it five. This looks quite logical, for the diminishing numbers indicated to him how much of his day's toil was to come. Another explanation which is probably the foundation of "secondly" and "thirdly" above, is the fact that mathematics and superstition were closely allied in the old days of Japan. If you take the numbers 1 to 6, Fig. 23, and multiply them each into the uncanny "yeng number," or nine, you will find that the last digits, reading downwards, give 9, 8, 7, 6, 5, 4. Stated in other words: When 1 to 6 are multiplied into "three times three" the last figures are 9, 8, 7, 6, 5, 4, and *1, 2, 3, have disappeared;* so the common people were filled with fear and awe. Some of the educated, even now, are mystified by the strange results produced by using three and nine as factors, and scientific journals often give space to the matter. We know that these results are produced by the simple fact that nine is one less than the "radix" of our decimal scale of numbers. Nine is sometimes called the "indestructible number," since adding the digits of any of its powers gives an even number of nines. But in those days it was a mystery and the common people feared the mathematicians, and I have no doubt the shrewd old fellows took full advantage of their power over the plebeians. In Japan, mathematics was not cleared of this rubbish till about 700 A. D.

On the right-hand side of Fig. 23 are given the animal names of the hours, so the day and night hours could not be mistaken. In selecting the *rat* for night and the *horse* for day they showed good taste. Their fore-

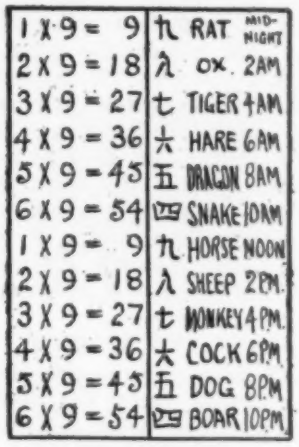


Fig. 23—Use of "Yeng Number" and Animal Names of Hours

noon was "before horse" and their afternoon "after horse." Japanese clocks are remarkable for variety. It looks as if they were always made to order and that the makers, probably urged by their patrons, made extreme efforts to get in wonderful motions and symbols relating to astronomy and astrology. Anyone examining about fifty of them would be likely to conclude that it was almost hopeless to understand them all. Remember, this is the old Japanese method. Nearly all the clocks and watches I saw in Japan were American. It will now be necessary to close this chapter with a few points on the curious striking of Japanese clocks.

In those like Figs. 14, 15, 19, the bell and hammer can be seen. In the type of Fig. 16, the whole striking mechanism is in the weight. In fact, the striking part of the clock is the weight. On each of the plates, having the hour numerals, Fig. 16, a pin projects inwards and as the weight containing the striking mechanism, descends, a little lever touches these and lets off the striking just when the pointer is on the hour numeral. Keeping this in mind, it is easy to see that the clock will strike correctly when the hour is indicated by the pointer,

no matter how the hour plates are set for long or short days. Similar pins project inwards from movable plates on Figs. 12, 13, 14, 15, so they strike correctly as each hour plate comes to the top just under the point of the fixed hand. In Fig. 19, the striking is let off by a star wheel just as in old Dutch clocks. Clocks like Figs. 18-22 do not strike. In all cases the hours are struck backwards, but the half-hours add another strange feature. The *odd* numbered hours, 9, 7, 5, are followed by one blow at the half hour; and the *even* nours, 8, 6, 4 by two blows, or stated altogether—

$$9_1 \quad 8_2 \quad 7_1 \quad 6_2 \quad 5_1 \quad 4_2.$$

Here the large figures are the hours and the small ones the half-hours. Only one bell is used, because there being no one and two among the hours, the half-hours cannot be mistaken. This is not all, for you can tell what half hour it is within two hours. For example, suppose you know approximately that it is somewhere between 9 and 7 and you hear the clock strike 2, then you know it is half past 8. See the large and small figures above. This is far superior to our method of one at each half-hour.

By our method the clock strikes *one* three times consecutively, between 12 and 2 o'clock and thus mixes up the half hours with one o'clock. Some interesting methods of striking will be explained in the third chapter when we deal with modern time keeping, closing with suggestions relating to a universal time system.

(To be continued)

MOVING A 55,000-TON BUILDING

The illustration shows the public library of Springfield, Mass., being moved to make room for the new Carnegie library. It will be demolished as soon as the other is completed. The excavation for the new building may be seen to be begun in the picture. The weight of this building is estimated at 55,000 tons and therefore its moving was rather unusual, although it was accomplished without accident and within the promised time. It was moved the required 200 ft. in 20 days by 12 men turning screws.

After the building was jacked up on some hundreds of jack-screws, the

Moving the Springfield, Mass., Public Library

foundations were removed, and the weight let down onto twelve 100-ft. I-beams which rested on 1,000 steel rollers, 2 in. in diameter, placed as near together as possible. The rollers rested on 12-in. timbers faced with long strips of iron ¼ in. by 6 in.

Horizontal screws pushing against the upper timbers, and held by blocks chained to an anchorage furnished by the substituted under-pinning beneath the center of the building, moved it back at the rate of 10 ft. a day, or about one-quarter of an inch a minute.

In the second illustration, may be seen five of the men who did the work. These men turned together at a signal from a foreman, making one complete revolution of the screws at a time.—Contributed by H. H. Cutter.

FIREMEN RESCUE AUTOMOBILE

The breaking of the steering gear of a taxicab when on the Jackson boulevard bridge in Chicago resulted in injuries to the chauffeur and two passengers and the calling out of two fire companies. The machine just missed a 12-in. girder, and breaking through the bridge railing hung suspended over the brink. The occupants were thrown out before the taxicab struck the rail and after rescuing them "hurry" calls were sent to two nearby fire stations. A squad of policemen and the firemen succeeded in getting the machine back onto the bridge after an hour of labor.

DISINFECTING AND CLEANING SCHOOL BOOKS

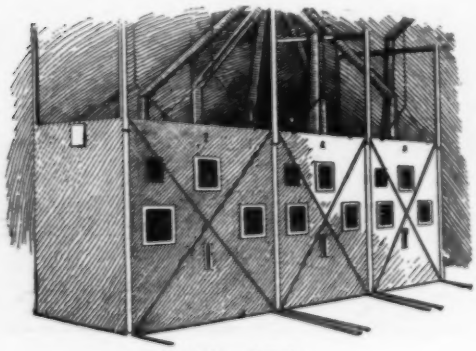
The fact that sanitary experts and physicians prove that many diseases

Machine That Removes the Dust

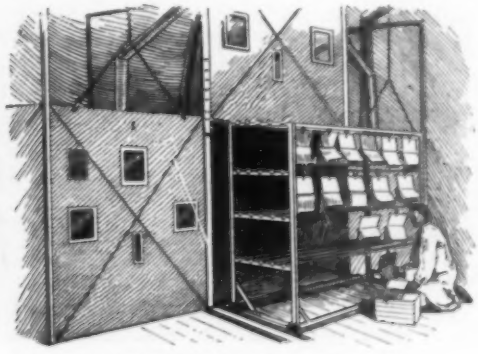
are spread by germs conveyed from hand to hand in school books has led to this remarkable and ingenious disinfecting and cleaning plant in France. It consists of a machine which sucks all the dust from the leaves and bathes them in a disinfectant, and a great drier in which they are subjected to hot air.

A strong current of air is driven through the dust-removing machine, and this separates the leaves of the books and sucks the dust from them. It also passes them through the long funnel-like device in which they are given the disinfectant bath. After this treatment, the books are placed on racks in the drier and left there until the hot air effectually accomplishes its work.

It would seem that such treatment would ruin a book, but a volume comes out of it, as far as binding, shape and

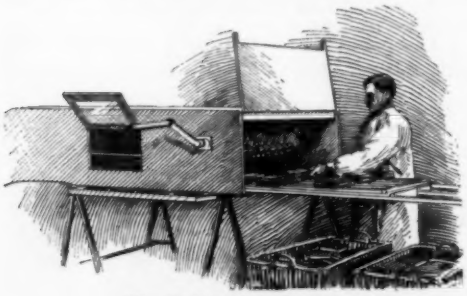


Exterior of Drier



Placing Books in Drying Racks

legibility are concerned, in as good



The Disinfecting Chamber

condition as it went in, and minus the death-dealing germs.

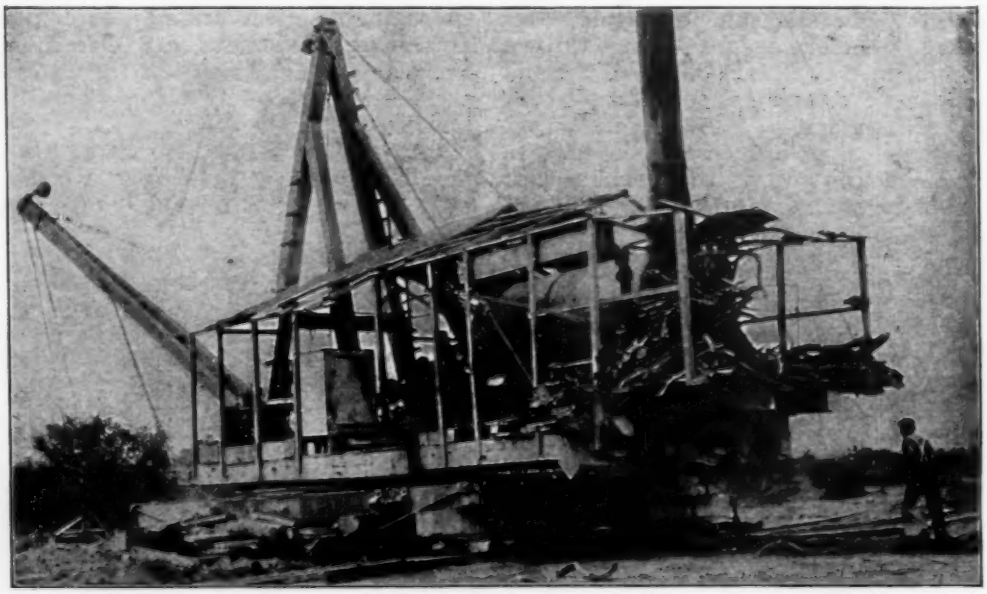
EARNING POWER OF A DREDGE

A number of dredges are in operation in the lower valley of the Rio Grande in Texas, constructing canals and ditches for large systems of irrigation. One of these dredges, which was built in a wilderness of brush upon what is known as the San Benito tract of land, dug 14 miles of canal of a width of 20 ft. on the bottom and a depth of 4 to 15 ft. during the twelve months that it has been in operation. This dredge has made a profit of $18,000 for its owner during the period that it has been in operation, besides paying for itself and $5,000 of losses that were incurred in the early stages of the work after its completion.

AVIATOR FALLS 3,000 FT. UNHURT

In a remarkable aerial accident at Berwyn, Neb., Sorenson, a village blacksmith who has been trying to solve the problem of aerial navigation, fell with his aeroplane from a height of over 3,000 ft. without receiving more than slight bruises.

Sorenson's machine is different from all others in many features, but especially so in the fact that a start is made from a balloon, instead of from the ground. On June 14 he attached his machine to an ordinary gas balloon, according to press reports, and ascended to a height of about 3,500 ft. He was then cut loose from the balloon, but instead of making a gradual ascent, as intended, the machine turned over and over, furnishing enough resistance, however, to act as a parachute and break his fall. The machine was in reality a glider, having no propeller or engine.



Dredge That Has Paid for Itself and Has Greatly Profited Owner

ARTIFICIAL HAIR OF SPUN GLASS

Spun glass as a substitute for human hair is claimed a success after long experiments. Wigs made from it are said to be wonderfully light and fine, the texture soft and beautiful, and the imitation so realistic and true to life that it is impossible to detect the difference between it and real hair. It is easy to produce any shade desired, while curls and waves can be manufactured at will to keep pace with the changes of fashion.

The enormous demand for artificial coils and toupes is leading to a famine in human hair. Formerly Swiss, German and Hungarian girls supplied most of the demand, but several governments have now made it illegal for a girl to sell her hair or for an agent to buy it. This action is taken because a girl shorn of her hair ceases to present a pleasant appearance and lowers the annual list of marriages.

REFRIGERATION PIPES FORM SHELVES

This fish-freezing room in a storage plant at St. John, N. B., Canada, is interesting because of the arrangement of the refrigeration pipes. They are arranged in such a way as to form shelves on which the fish, previously packed on trays, are placed and frozen at very low temperatures. After freezing, the fish are taken out of this room and glazed; that is, covered with a thin layer of ice.

Fish Are Placed on These Pipes

DISINFECTING SUITS FOR HEALTH OFFICERS

The state health department of Pennsylvania is providing its health officers with these suits to be worn when disinfecting rooms or homes in

Pennsylvania's Disinfecting Suits

which contagious diseases have been prevalent. They are made in the form of union suits with interlocking flaps at the neck and tapes at the wrists and ankles, so that none of the body surface or clothing, other than face, hands, and shoes is exposed. The health officers also wear gum shoes, and these can be sponged off with a bichloride solution after use. The suit, after using, is sprinkled with a formaldehyde solution, rolled into a compact bundle, and placed inside of a watertight container. Before removing the suit the wearer washes his hands and face in a weak solution of bichloride of mercury.

At a dinner given in honor of Ambassador O'Brien in Tokio, he made the statement that America requires trade ships rather than warships to preserve the peace of the Pacific.

THE PEANUT INDUSTRY AND ITS POSSIBILITIES

The Peanut Can Be Grown in All the Southern States Clear Across the Continent—Many Uses for the Nut Other than Known by the People in General, Including Salad Oils, Meals, and Vegetarian Meats — By-Products Used as Fertilizer and for Stock Feeding—Kind of Land Required and Method of Planting and Harvesting

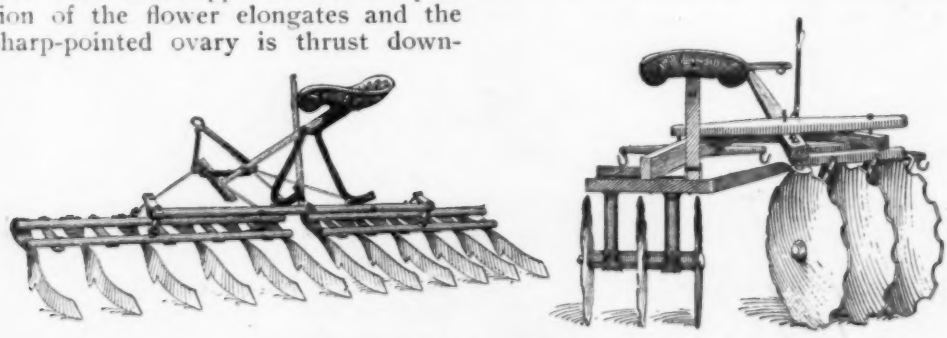
[Condensed from Article by W. R. Beattie, of the Department of Agriculture]

Before dealing with the peanut as an industry, describing its growth, method of cultivation, and the uses for which it is grown, it is well to explain just what the peanut really is. It is not a nut, as popularly believed, but a pea, belonging botanically to the same group of plants as do the beans and peas, but possessing the characteristic of maturing its fruit or pea beneath the surface of the soil, rather than above ground. The term "nut" was added to the "pea" because of its flavor, which is similar to that of many of the true nuts.

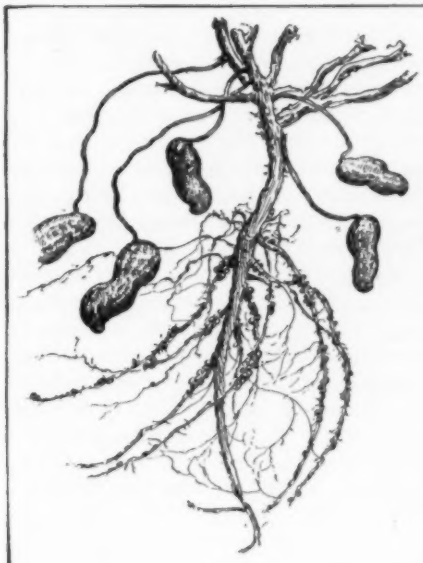
The small yellow flowers of the peanut are borne in the little pocket where the leaves are attached to the stems, and as soon as pollination has taken place the visible portion of the flower fades and falls, after which the short, thick stem that supports the lower portion of the flower elongates and the sharp-pointed ovary is thrust downward into the soil, where the pod develops. Should the ovary fail to reach or penetrate the soil no pod will be formed.

The peanut is rapidly becoming an important farm product throughout the southern states. Its vines are valuable as forage and the peas that are not marketable can be used for feeding purposes. Throughout the boll-weevil district of the cotton belt the peanut is grown as a money crop, and special oil-producing varieties will assist in keeping the oil mills of the southern states supplied with raw materials. The value of the commercial peanut crop of the United States for the year 1908 was estimated at $12,000,000.

Although the majority of people recognize the peanut only as it appears for sale in the shell, hulled and salted, as peanut candy, or in the form of peanut butter, many new lines of consumption have been found for it in the past few years. In addition to these uses, it is an ingredient of peanut and vegetable meats, peanut meal, and salad oils. In the preparation of vegetarian meats a portion of the oil is pressed from the ground peanuts, other ingredients, including vegetable substances, are added, and the whole is crushed and pressed into tins ready for use. Peanut meal, made from finely ground blanched peanuts, is used in confections, such as almond macaroons and small cakes, to which it imparts the desired almond flavor. Peanut oil is used in the same manner as olive oil; also for mixing with cotton-seed oil in order to improve the quality of the seed oil for salad purposes. Peanut oil is of somewhat lower value than first-class olive oil, and is sometimes mixed with it for the production of an oil that can be sold at a lower price



Harrow and Disk for Sandy Soil



Roots of Vine Showing How Peas Are Attached

Laborer Building Shock Around Stake

than pure olive oil. On the other hand, it is of a higher grade than cotton-seed oil. With a coming shortage of cotton seed from which to manufacture oil in this country, there is a great possibility of building up a peanut-oil industry throughout the cotton belt that will keep the oil mills flourishing. A bushel of first-class peanuts, weighing 28 lb., will produce about 1 gal. of oil, worth 45 cents, and 20 lb. of oil cake and hulls, which, when ground and mixed together, is worth approximately 25 cents. Such peanuts must be obtainable at prices not exceeding 40 cents a bushel to make the oil industry profitable.

By-products of the peanut are used in the manufacture of feeds for farm stock and dairy cows, and the plant is being largely utilized as forage and as a soil renovator. In large cleaning factories the shells are generally used for fuel, and the ash resulting therefrom is valuable as a fertilizer. The thin brown covering of the peas or nuts has a feeding value almost equal to that of wheat bran, and is especially desirable for mixing with the smaller particles of broken peas for stock feeding.

The peanut is well adapted for use as a part of the cropping system in the southern states, especially on the cotton and tobacco lands. Soils that will not produce more than one-fourth of a bale of cotton to the acre can be made to yield a fair crop of peanuts at a very low cost for growing. Comparatively few planters realize the value of peanuts when used as a farm crop, especially when the product is fed to live stock on the farm and eventually returned to the soil as fertilizer.

The soil best suited for the peanut is one of sandy, loamy nature, perfectly light or grayish in color rather than dark. Soils that are dark and those carrying a considerable percentage of iron or other mineral, are likely to stain the shells of the peanut, thus rendering them less desirable for the trade. As a rule, the peanut does best on a sandy loam with a well-drained clay subsoil, but the crop may be grown under a wide range of soil conditions. For agricultural purposes, of course, the staining of the shells is of little consequence, as it does not materially injure them for stock feeding.

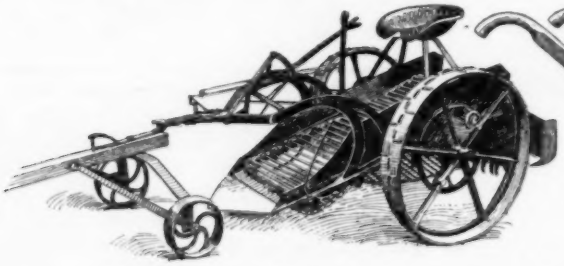
The cultivation of the peanut for

commercial purposes has until recently been confined chiefly to areas in Virginia, Tennessee, the Carolinas, and Georgia. Now it is established throughout the South Atlantic states and westward to, and including California. The area of the peanut section is one within which the frost-free season is comparatively long. The best climatic conditions are a long season without frost, a comparatively light rainfall during the growing period, abundant sunshine, and a light temperature.

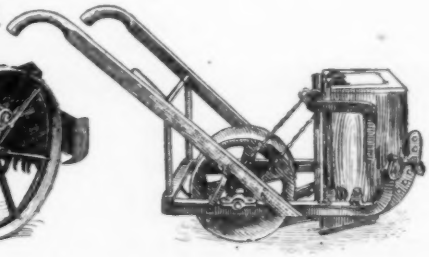
The time for plowing the land will depend somewhat upon its previous treatment. If the land has been in corn the season before, and a crop of crimson clover was sown at the same time the corn was laid by, it will be desirable to plow the land just before the clover blooms, in order to get the greatest benefit from it as a green manure. If the land is sod it will be desirable to break it during autumn or winter. If there is no crop on the land, the plowing need only be done in time for planting. From 5 to 7 in. of loose soil is sufficient for the growing of all varieties of peanuts. On loose, sandy soils that are reasonably free from weeds or grass it is often possible to dispense with the regular plowing and cut the land with a disk plow of the kind shown in one of the illustrations. Where plowing is necessary in order to turn sod, clover, or weeds under, a harrow, also shown in the illustrations, should be used for smoothing and pulverizing the soil afterwards. This harrow is superior to the ordinary smoothing harrow in that it turns, crushes, and levels the soil in one operation.

Under ordinary circumstances, level culture should be practiced, but where the drainage is poor it may be advisable to throw up slight ridges. This is especially desirable during a season of excessive rainfall. If the soil can be harrowed once a week for three or four weeks before planting, most of the weeds that would otherwise injure the crop will be destroyed.

A good grade of seed is just as important with the peanut as with corn, wheat, or any other crop. There is perhaps no other farm crop except corn that is so greatly influenced by the character of seed. The very best peanuts of the previous season's crop should be selected for seed, and of these only the most mature and perfect peas should be used.



Machine Peanut Digger



One-Horse Peanut Planting Machine

The time for planting is in the spring after the soil has become thoroughly warm. In order to secure a good stand, the seed should not be put in the ground until there is sufficient warmth to germinate it quickly. As a rule, peanuts should be planted a trifle later than corn and beans. A common distance between rows is 36 in., but this varies somewhat, according to the soil and variety.

Cultivation of the crop should begin as soon as the rows can be followed, and continue until the vines begin to occupy the ground. The work of cultivation should be pursued very much the same as for corn, beans, and all similar crops.

No fixed rule can be given by which to determine when to remove the peanut crop from the ground, and each grower must be his own judge in the matter. In general practice the grow-

ers aim to dig before the first frost in order that the vines may have greater value for stock food. The aim should be to dig at the time the vines have upon them the greatest number of matured nuts. Under ordinary circumstances the peanut vines are plowed from the ground with a one-horse turning plow and afterwards separated from the soil by hand, but it has been found that a regular potato digger, adapted for harvesting peanuts, is the best, not only removing the vines from the ground in a more perfect manner, but also shaking off the soil and leaving the vines lying loosely upon the surface of the ground.

After the vines are loosened from the soil, they are allowed to lie either spread upon the ground or in small bunches for three or four hours, and then placed in small stacks around a central stake to cure. If allowed to lie exposed to the weather for any length of time after digging, the pods become discolored and lose in weight. Peanuts for market should be cured in the shock at least three or four weeks before picking. If not well stacked, the pods are liable to become discolored by the heavy fogs and driving rains of late autumn. The stacks should not be opened, or the vines handled during wet weather.

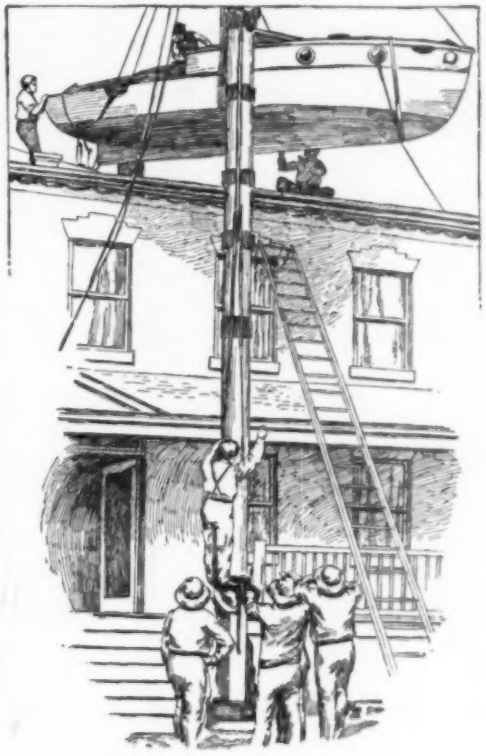
While the average yield of peanuts is only about 34 bu. an acre, with proper methods a yield of 60 bu., and 1 to 1½ tons of forage may be reasonably expected.

PORPOISE SAVES SHIP

The Mallory line steamship "Concho," plying between New York and Galveston, struck a submerged wreck and received damages which allowed more water to enter the hold than the pumps could at first remove. Later, to the great surprise of the captain, the pumps gained control, and the next morning divers discovered that a porpoise had become so tightly wedged in the hole that but little water could get into the ship.

BOAT LIFTED OVER HOUSE TOP

Instances have been known in which enthusiastic amateur boatsmen have

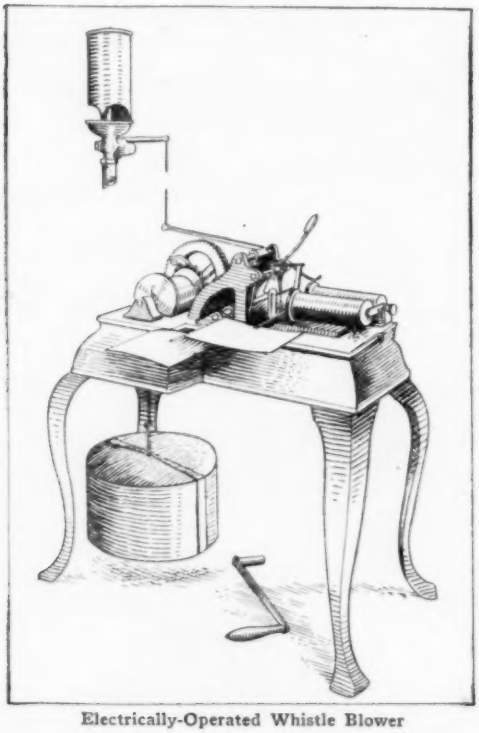


Only Means of Access to Street

built their small vessels in a home workshop or basement, only to find when completed that to get them out would require the tearing down of the side of a brick or stone building, but this is even a more extraordinary example of being "walled in." A Philadelphian built this raised-cabin cruiser in the small back yard of his home, and found when the time for launching came that to get it to the street in the ordinary way would require the demolishing of at least one of several buildings. The boat, with engine, weighed about 5,000 lb., but by means of two large derricks and much tackle, it was lifted from the yard to the roof of the house, then over it and eventually down onto the street.

MACHINE DESIGNED TO BLOW WHISTLES

This whistle-blowing machine is composed of a standard, a 75-lb. weight, 3 gears, a set of fans, a blowing lever, and the necessary electrical installation to release the weight. It will operate any whistle in any system, the length of the blast being determined by the speed of the gears, and being regulated by the fans.



Electrically-Operated Whistle Blower

The gears are held in check by a release lever, the end of which rests on the studs of an electric-magnet armature. It is so arranged that the movement of the armature away from the magnet when a closed circuit is used, or towards the magnet when an open circuit is used, releases the lever, allowing the gears to start. The center gear, which engages with the end of the blowing lever, makes one blast of the whistle at every revolution.

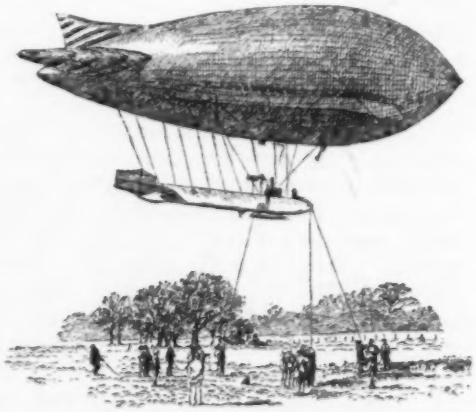
The weight is used in preference to springs, because it does not change its tension, and when once adjusted only requires to be occasionally rewound.

UP-TO-DATE HOTEL ROOFS

Not many years hence a hotel will not be up-to-date unless its roof is turned into an airship station, and several hotels in other parts of the world and one in Philadelphia have already made preparations, doubtless expecting immediate advertising and future aerial guests. The aerial garage planned for the roof of the Philadelphia hotel will have a repair shop, stored electricity, gasoline, and all the paraphernalia needed by aerial navigators. A wireless station, now on the roof and used for communicating with other stations on the land and at sea, will then be used for receiving room reservations from aerial travelers as well.

ENGLAND'S "FLYING FISH" AIRSHIP

England, somewhat frightened by the success other European powers are having in the science of aerial flight, is now making great efforts to make up for lost time. Its new dirigible airship, "Flying Fish," is now having its trial flights, which, so far, have proved her more efficient than the "Nulli Secundus," England's first dirigible.



England's Latest Aerial Venture

The curious tail protuberances of the new aerial craft make it look very much like a fish or bird. The gas bag is 100 ft. long, and the car, which is boat-shaped, has side wings. A 2-bladed propeller is driven by two 12-hp. engines. The steering rudder is controlled by means of a wheel of the type used on automobiles.

SCHOOL PROPOSED FOR HOTEL EMPLOYES

The national organization of hotel managers have under consideration the proposition of establishing a national training school for hotel employes in connection with an institute at Indianapolis. In beginning this school it is proposed to build a complete hotel, and one large enough to accommodate 500 pupils. Young men and girls who intend to make hotel-keeping their profession will be placed in it and taught system, discipline and all the a b c's of the profession. The young men will be given actual training in the storeroom, kitchen, dining-room and office, and the girls in the laundry, and housekeeping departments.

NEW METHOD OF CARRYING PERSONS ON SHOULDERS

A new method of carrying injured, unconscious, or frightened persons on the shoulders without strapping them there, yet leaving the hands, forearms and legs of the rescuer free, has been devised by Dr. Charles M. Duncan, of New York, and successfully tested by the fire department of that city.

The fireman faced with the necessity of carrying a person down a ladder at a fire, thrusts his right arm around the right thigh of the person to be rescued and swings him onto his shoulders. He then secures the right forearm of the rescued person between his (the fireman's) right upper arm and chest, and held tightly in this position with the right upper leg of the rescued person against the fireman's right side there is no danger of the load slipping from his shoulders. At the same time, this method of carrying leaves the fireman's forearms, hands, and legs free to aid him in his descent, and as the weight

The Duncan Method

is being carried on the center of the shoulders, which is the position where the maximum load is carried with the minimum of exertion, the weight is not overburdening. Also, carrying the person in this position allows the rescuer to face the ladder or fire escape he is descending, giving him the opportunity to examine each rung or step before placing his foot upon it. The center of gravity of the fireman and the rescued persons when thus locked to-

gether falls directly in the line of the center of gravity of a person standing in a normal position, that is, directly between the feet. When on a ladder or fire escape this gravity falls half way between the vertical uprights, thus enabling the fireman to easily maintain his equilibrium.

HIGH WIND PERFORMS FEAT

This particular freak of the high winds has been added to many others.

Flying Sliver Splits Tree

The inserted piece of wood was at one time a part of a large barn. In a tornado last April which destroyed barns and houses, the wind lifted a 50-ft. section of the barn over the house and carried it for a distance of 30 rods. One of the splinters from the flying building was driven into a tree limb, entering with the small end and left in the exact position the illustration shows. The house was undamaged but the barn was completely destroyed.

THE SEARCHLIGHT AND THE AIRSHIP

In a lecture by Col. F. G. Stone before the Royal United Service Institution of Great Britain he declared that locating and keeping aerial craft illuminated by the aid of searchlights will be a difficult problem in the warfare of the future, because of their extreme mobility.

"Instead of solitary searchlights here and there," said Col. Stone, "there will have to be one skyward blaze of light from all over the area of danger. The aeronaut, blinded by the continuous glare and himself visible to all the defenders below, will have to fly to the edge of the shining battlefield, there to be sought out by single searchlights and followed by shells from the guns below."

A REFRIGERATING TURBINE

A French inventor has constructed a refrigerating machine of entirely new type. This machine consists of the combination of a steam ejector with a turbine used as a condenser. The steam ejector used with the condenser produces a vacuum over a receiver filled with brine; the water, as it evaporates, produces a progressive degree of refrigeration.

The steam jet, as discharged from the ejector, enters a receiving chamber, where the steam passes through a series of converging tubes, which at their outlet end are again made to diverge. Thence the steam reaches the condenser which is a reversing turbine with the injection of water at the center. The steam from the ejector, together with that from the brine vessel, which is carried over along with it, becomes condensed in the turbine. A centrifugal pump, keyed on the same shaft as the condensing turbine, causes the active circulation of the brine. The constant vacuum maintained in the receiving vessel helps to draw in brine. The steam pressure at the ejector is 4½ lb., and in expanding, it assumes a speed of 3,900 ft. per second. By

means of this machine it becomes possible to obtain the starting temperature of 39 deg. F. of the brine, a refrigeration equivalent to 180 frigorific units per foot of steam expended. The machine is simple in action and has no valves to wear out and uses no chemicals that will form a reaction of any kind.

EXCAVATING FOR STREET PAVEMENT WITH STEAM SHOVEL

Nearly 20,000 cu. yd. of excavation, in a cut ranging from 14 to 18 in. in depth, is being taken from the surface of a street in Chicago by a steam shovel of the revolving type. The street is to be paved with granite blocks on a 6-in. concrete base. The full circle revolution of the shovel permits the dipper to take a cut at any point in the circle and deliver its load at any point, while the horizontal crowding motion of the dipper enables a perfectly level and shallow cut to be made.

TURNTABLES FOR AUTOS AT HOTELS

This drawing is the suggestion of an English automobile magazine for the avoidance of the annoyance caused by automobiles backing into position when leaving several of the London hotels where the space is so restricted that the cars have to be maneuvered.

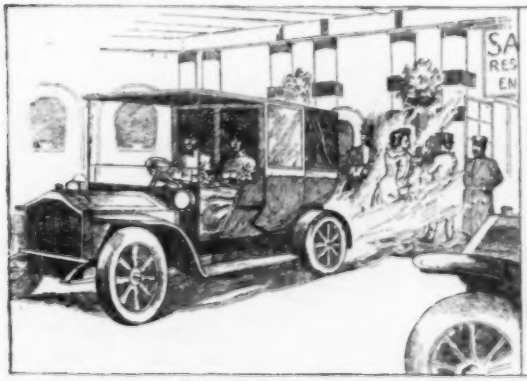
The idea is one that is just as adaptable and just as necessary in front of or in the courts of many of the metropolitan hotels and amusement places in this country. The exhaust smoke is anything but pleasant to those entering or leaving such places on foot.

IMMENSE BARN IN OHIO

The largest barn in Ohio, and one of the largest in the United States, has been constructed on a large farm near Lake View. It is an unusual structure,

A Sky-Scraper Barn

built in circular form. It has a diameter of 102 ft., is 90 ft. high, and has a silo 40 ft. high and 18 ft. in diameter in the center. The basement is fitted up with stalls for horses, a great corn-crib takes up part of the first floor, and 200 tons of hay can be stored in the mow. Grain is stored in apartments over the outside stock shed.

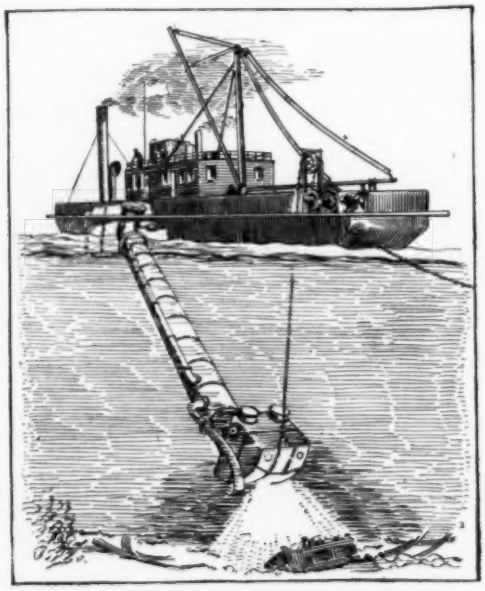


The Old Way

A Suggested New Way

VESSEL TO PROBE OCEAN'S DEPTH

This odd vessel with its huge steel arm searching the ocean bed was designed by Simon Lake, an Englishman,



"The Tube Is 95 Ft. Long"

for recovering buried sea treasure. The incident that led to its construction was the sinking of the British man-of-war, "Lutine," off the entrance to Zuyder Zee river, with $5,872,000 of bullion and specie aboard in the year 1789.

The arm of the submarine tube is 95 ft. long and 5 ft. in diameter. Two large sand pumps of a great capacity are attached to its sides. The little working chamber at its end is 8 ft. square. Both the tube and the chamber are of plate steel and the former is hinged to an inner apartment of the surface vessel. It is provided with a stairway for the workmen going to and from the chamber. It is also fitted with searchlights and observation ports and has large doors in its bottom, opening out.

In wrecking, the submarine arm is moved by anchor lines, but in searching the bottom, it swings from the surface vessel and follows its movements. Its other more novel way of locomotion is by a huge traction wheel in the chamber which grips the bottom of the ocean with its teeth and is propelled mechanically.

The illustration shows the submarine arm searching an old sea wreck.

EDUCATIONAL COURSES IN EATING

Banquets or other large dinners, with their attending courses, in each of which several varieties of spoons, forks and knives are used, and quite often wrongly according to social laws and customs, will have no terror for the people of Budapest if an enterprising woman of that city has her way.

She has opened a school where pupils of all ages will be taught the art of dealing successfully with such dishes as they are not accustomed to ordinarily. Many people have experienced moments of unspeakable anguish at dinner parties on finding that they were using a knife and fork for a dish that only required a spoon, or vice versa, and in all probability many will be glad they went through the educational course before starting in on the dinner courses.

PROPER WAY TO ROLL BOILER PLATE

These drawings show the correct and incorrect way of rolling sheets of boiler plate. Boiler plate when ordered the long way should be rolled so that the long side of the sheet is curved. That

FIG. 1.

FIG. 2.

is, the short side of the sheet should pass through the rolls parallel to the axis of the rolls. The first drawing shows the correct shape of the sheet after rolling, and the second the incorrect.

TUNGSTEN ORE REFINERIES

The only mill in this country now refining tungsten ore, the metal which has made possible the cutting in half of electric light bills, is at Boulder, Colo., but another mill is to be built at Round Mountain, Nev., and still another is proposed for Spokane, Wash. The group of tungsten claims at Round Mountain aggregate a total of 850 ft. of work in three crosscut tunnels which have cut a belt estimated to be from 150 to 175 ft. wide, containing a large number of veins and stringers carrying from 3 to 36 in. of tungsten ore. At least 50 veins have been cut in the three tunnels, and the values run from $6 to $300 a ton at a conservative estimate.

PART OF BOILER DRIVES TROLLEY POLE THROUGH WINDOW

The trolley and electric light pole shown protruding through the second-story window of this store in Fond du Lac, Wis., arrived in that position from a peculiar accident. The boiler in a heating plant more than a block away exploded, and the boiler dome, thrown through the air with great force, struck the pole several feet from its base, broke it off sharp, raised it into the air, and drove the end through the window. The flying piece of metal, weighing a little more than 200 lb., passed clear over the 100-ft. tower of the Fond du Lac courthouse before striking the pole.

Extraordinary Result of Boiler Explosion

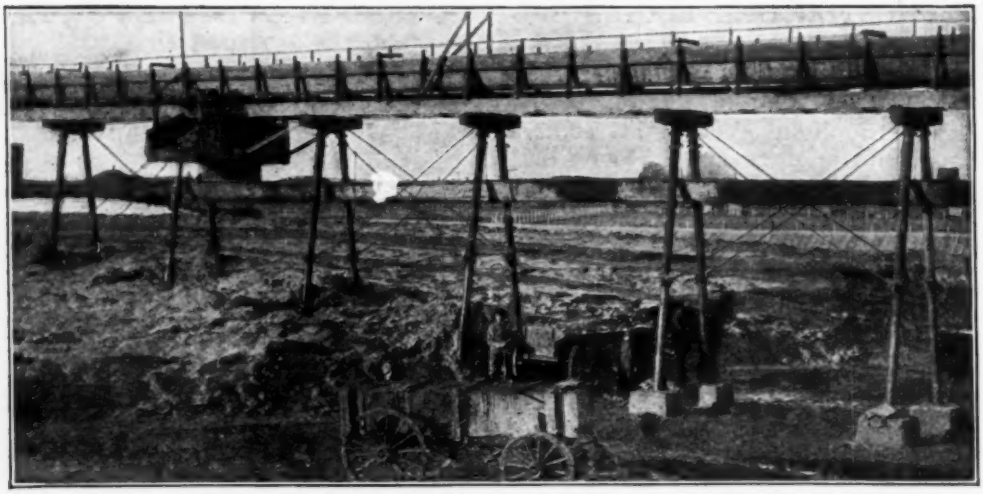
CORKED IN A BOTTLE FOR TEN DAYS

The majority of men of the German race are large, especially around the waist, and many of them for that reason would be unable to get inside this bottle-like cell with comfort. It is doubly possible for this German to do so because his build is not large, as far as the waist is concerned, and because when he enters it he stays bottled up for 10 days without food. Air is admitted to him through the neck of the bottle.

ARMY OFFICERS STUDY FIELDS OF WAR

In June, 100 soldiers of the regular army, 30 of whom were officers, and the remainder their escort, returned to Washington after nearly a month in the saddle, during which time they traveled over 500 miles, taking in Fredericksburg and Richmond and the historic region of the Shenandoah valley. The object of the march was to learn by practical study of the battlefields of the Civil war, just how, when, and where the troops were handled; what was done best and worst, and to study the ground.

Another practice march is to be undertaken by the war college, covering the Gettysburg campaign.



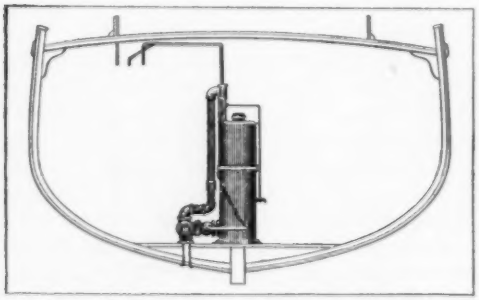
Pulp Flume of Beet-Sugar Factory

BEET PULP FOR FATTENING LIVE STOCK

Beet pulp is used extensively in sugar factory districts for fattening hogs, sheep and cattle. The illustration shows the flume which carries the beet pulp from a sugar factory to the point where it is loaded on wagons. Running water in the flume acts as the conducting force. The sugar-beet pulp, mixed with alfalfa, makes an invaluable food product for live stock.

ACETYLENE FOR SMALL BOAT ILLUMINATION

The question of efficient illumination on sail yachts or motor boats of less than 60 ft. in length without taking up an uncomfortable amount of the limited space for apparatus, is one calling for serious consideration by all small boat owners. To meet the requirements of such boats several lighting systems have been developed, among which is the acetylene system here described.



Calcium Carbide Generator Installed on Boat

The cylinder which contains the carbide and generates the gas is placed in one corner of the engine room or compartment of a motor boat and in the gallery of a sail yacht, taking up no more floor space than a bucket. This generator is automatic and self-cleaning in its action, the residue being automatically discharged overboard. Refilling the generator only requires the pouring in of new carbide, like so much rock salt, about once a month or so, according to the number of lights it supplies and the length of time they are kept burning. The plant takes its supply of water automatically through the bottom of the boat.

With such a system, dome and side-bracket lights can be used to light the saloon cabin and other compartments of the little vessel, the searchlight, side signal lights, bridge binnacle light, and deck lights can be fed, and a cook stove of two or more burners can be operated.

All the lighting fixtures are fitted with electric lighters, receiving current

from dry batteries. The pressing of a button or the turning of a key snaps a spark that ignites the gas. The light, being a very small flame, does not give out much heat, while the stove gives out more heat than coal gas, because the carbide gas is air-mixed.

Calcium carbide resembles flinty rock of dark grayish color. It will not burn, but when brought into contact with water gives off a gas. This action is similar to slacking lime, and, in fact, calcium carbide is composed of 60 per cent lime and 40 per cent of coke electrically fused. It gives out no odor when burning, but in itself has a strong pungent odor.

The illustration shows the method of installing the plant on a boat and its water connections through the hull.

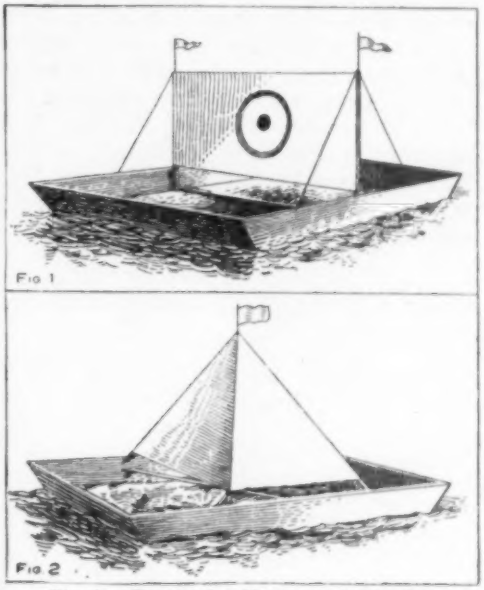
HAMMOCK HOOK COVERED BY TREE GROWTH

A section of a maple tree, in which a hammock hook was buried completely out of sight by its growth, was recently on exhibition at the office of the forestry department of the City of Cleveland. The hook was overgrown half an inch, and it was not found until the section of the tree in which it was buried was split open. There was from 20 to 25 years of growth over the place where the hook was originally attached.

Overgrown by Wood

FLOATING ARTILLERY TARGETS

The fact that a projectile from a cannon strikes on a horizontal line while a mortar drops its projectile from the heavens necessitates two distinct types of floating targets for the coast artillery.



Floating Targets for Mortars and Big Guns

For the 10- and 12-in. guns the targets are of the same type as those used by the navy. That is, the foundation is a flat-bottomed square-shaped scow, which is very rarely sunk because the projectiles pass horizontally above it. The targets for mortar practice are made by covering a pyramid framework of wood with heavy canvas, painted red, and bearing a red flag. This pyramid is mounted on a large, bottomless scow, so that the projectiles drop through and sink. These targets are shot at while stationary or while towed at a speed of about 12 miles an hour.

On several evenings in June, people near Imperial, Cal., believed they saw a mysterious airship, but it proved to be a mirage which took the form of a row of tents and cottonwood trees.

ROOF GOLF TOO COSTLY

The Hotel Walcott of New York recently installed a 6-hole golf links on its roof, with grass bunkers and other requisites of the game, but golf enthusiasts played the game so strenuously that within a period of six days the hotel proprietor was compelled to purchase new window glass for more than a dozen surrounding office buildings. The climax came when a golf ball shattered the skylight of an art gallery and damaged a valuable painting. Following this incident the golf links were closed.

HOW TO MAKE A PIANO BENCH

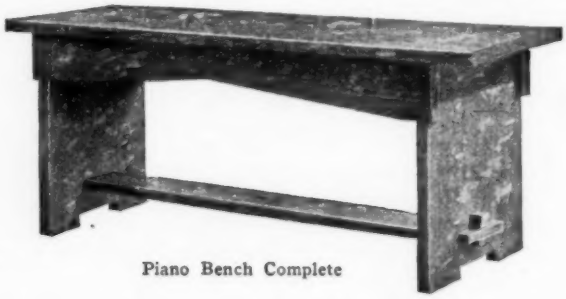
All the material used in the making of this piano bench is 1 in. thick, excepting the two rails, which are ⅞ in. thick. The bench can be made from any of the furniture woods, but the case may demand one made from mahogany. If so, this wood can be purchased from a piano factory. The following stock list of materials may be ordered from a mill, planed and sandpapered:

1 top, 1 by 16 by 36½ in.
2 ends, 1 by 14 by 18 in.
1 stretcher, 1 by 4 by 31½ in.
2 side rails, ⅞ by 4 by 29½ in.
2 keys, 1 by 1 by 3½ in.
6 cleats, 1 by 1 by 4 in.

The dimensions given, with the exception of the keys and cleats, are ½ in. longer than necessary for squaring up the ends.

The two rails are cut slanting from a point 1½ in. from each end to the center, making them only 3 in. wide in the middle. The rails are "let into" the edges of the ends so the outside of the rails and end boards will be flush. The joints are put together with glue and screws. The cleats are fastened with screws to the inside of the rails and to the top. The stretcher has a tenon cut on each end which fits into a mortise cut in each end. The tenons will have sufficient length to cut the small mortise for the key.

The kind of wood used will determine the color of the stain for the finish. This also depends on matching other pieces of furniture.

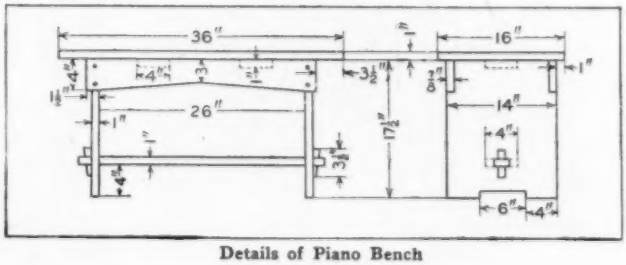


Piano Bench Complete

LARGE HOUSE BUILT FROM ONE TREE

A 14-room house was recently built at Elma, Washington, from the lumber of a single yellow fir. There was nearly 38,000 ft. of lumber in the logs of the tree, and the stump inside the bark measured 9 ft. The total height of the tree was 300 ft., its lumber was worth $1,000, and the trunk was straight and without a limb for 100 ft.

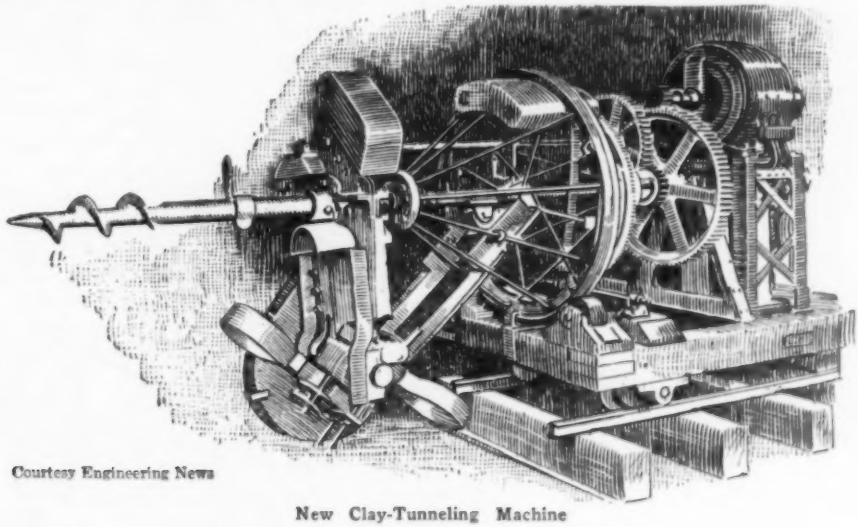
Statistics show that there is enough timber standing in the state of Washington to build 5,000,000 six-room houses, sufficient to shelter one-third of the population of the United States. The timber would furnish ties for 1,893,939 miles of railway track, or suffice to construct a plank road 3 in. thick and 500 ft. wide that would extend around the world twice.



Details of Piano Bench

WOMEN AERONAUTS IN PARIS

The first annual race of a woman's balloon club was held in Paris on June 16, and five balloons took the flight. The organization is known as the "Stella" Club, and the five balloons entered, the pilots and occupants of each being women, were the "Cornflower," "Carnation," "Peony," "Daisy," and "Rose." The cars of the balloons were decorated with the flowers for which they were named, and as they rose dozens of these were showered upon the heads of the spectators. Mme. Surcouf, president of the club, has made 13 ascensions.



Courtesy Engineering News

New Clay-Tunneling Machine

MACHINE FOR TUNNELING THROUGH CLAY

This machine is designed for tunneling where the earth formation is clay, or other soil. It comprises a revolving double-spoon excavator which works in a radial plane, cutting from center to circumference; an auger pilot which aligns the machine, and a frame which rotates the auger and excavator about the longitudinal center-line.

Its capacity is 10 ft. advance per hour in an 8-ft. drift, and it may be mounted on an ordinary truck car or be attached to the interior of a shield. When mounted on either truck or shield it is easily adjusted to line and grade, and to bores from 6 ft. up to any diameter. It is adaptable to cylindrical, egg-shaped or rectangular drifts, the only change necessary being in the manner of mounting it. The entire weight of the machine, including a 7½-hp. electric motor, is 2½ tons.

The machine has been named the "ground-mole" because it works automatically, cutting the clay from the breast by a combined transverse and longitudinal revolution of the knives. The excavated material is picked up by a belt conveyor.

REGULATING THE MOISTURE OF BUTTER

Experiments carried on at the Iowa State college to determine to what extent the moisture of butter can be controlled prove that it can be held within one per cent. The main factors which influence the percentage of moisture are: the churning temperature, per cent of fat in the cream, amount of cream in the churn, and the number of revolutions used in working moisture into the butter. The number of revolutions used in working in the salt, and the temperature of the wash water also have an influence. When a large

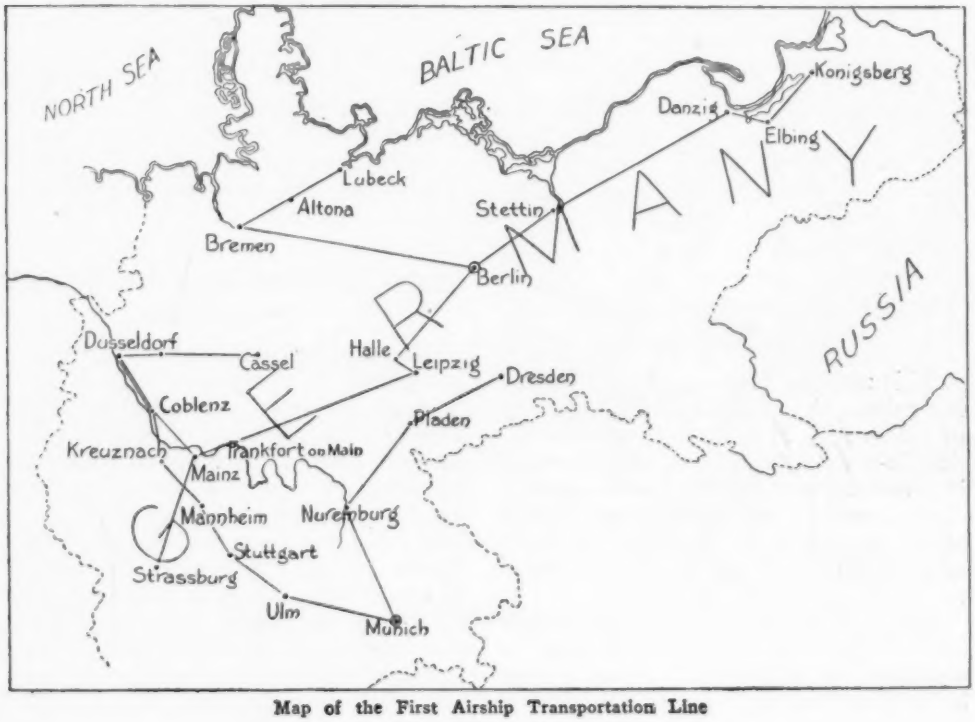
amount of cream is churned at once, the fat globules are not dashed violently against the sides, so that more moisture is retained in them. In rich cream the fat globules unite more readily because of being closer together, thus more water is retained than when the globules unite more slowly.

GERMANY'S COMMERCIAL AIRSHIP LINE

The project of a commercial aerial line in Germany will soon cease to be a mere possibility and develop into a fact. An aerial navigation company of Frankfort-on-Main is to, at once, connect 30 German cities in such a way with balloon stations and garages now being, or about to be built at Berlin, Munich and Strassburg. The first line of connection planned is Munich to Dresden by way of Nuremburg, Plauen, and Chemnitz. The second line is from Munich to Cassel by way of Ulm, Stuttgart, Mannheim, Mayence, Coblenz, Cologne, Düsseldorf, Elberfeld, and Paderborn. The third line is from Berlin to Lubeck by way of Bremen and Hamburg; the fourth, from Berlin to Konigsberg, and the fifth is from Strassburg to Berlin.

ENGINE DRAWS 85 LOADED COAL CARS

A record was made by the Pennsylvania railroad in the movement of heavy freight trains in a test to determine what could be done in actual road service. A train composed of 85 steel gondolas, loaded with a total of 4,451 tons of coal, was drawn by a freight engine of the most improved type over a run of approximately 124 miles in 7 hr. and 15 min., the average speed being 17 miles an hour. The total weight of the train was 6,151 tons, and its length 3,000 ft., or nearly three-fifths of a mile. The run was made between Altoona and Enole, Pa. The heaviest grade was about 12 ft. to the mile.



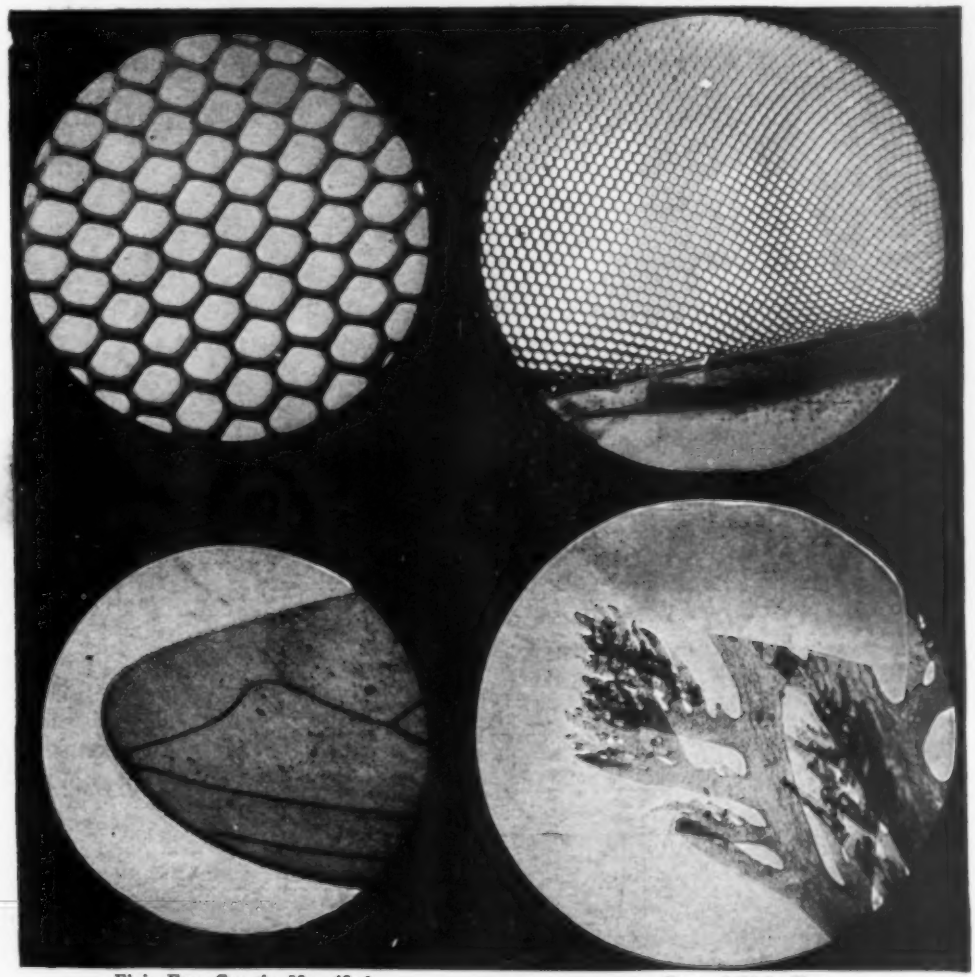
Map of the First Airship Transportation Line

BIG PICTURES OF LITTLE THINGS

By C. H. Claudy

Pictures which are very large in comparison with the objects of which they are made go by the long name of "photomicrographs." That is, they are photographs which are made through a microscope, or so made that they look like the images which the microscope shows.

Of course you know that a microscope is an instrument for magnifying—making little things seem big things. The optician defines it a little differently—as a mechanical means of holding lenses which magnify and focusing them on the object, and of illuminating the object. But all this simply means that the microscope is a little machine which holds glass lenses, and can move them very slowly and very delicately and that by means of a mirror and perhaps other lenses, a beam of light can be made to play on the little thing you want to look at.

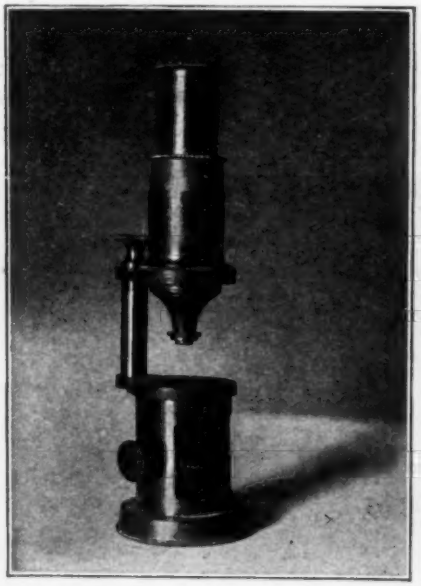


Fly's Eye, Greatly Magnified
Fly's Wing Tip

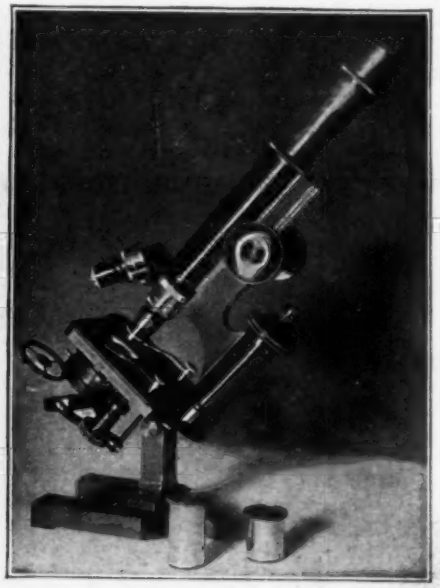
Part of Fly's Eye
Seaweed

Now the same things one sees when

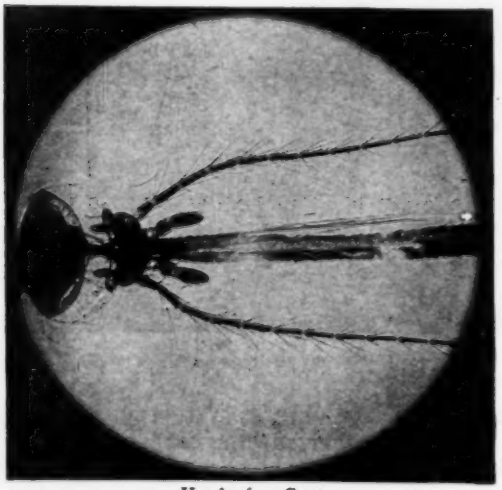
he looks through the microscope can be photographed. Moreover, many of these things can be photographed without a microscope at all, and many, many things can be photographed with a five-dollar microscope and any old camera at all. It only needs a little ingenuity and "know how." In the first place, before undertaking anything of any kind it is the part of wisdom to understand it. So the principle of a microscope combined with a camera should be understood, before the two are combined. We are going to omit from this explanation all technicalities and all very difficult optical "ifs" and "buts."



Simple Five-Dollar Microscope



A Fine Compound Microscope



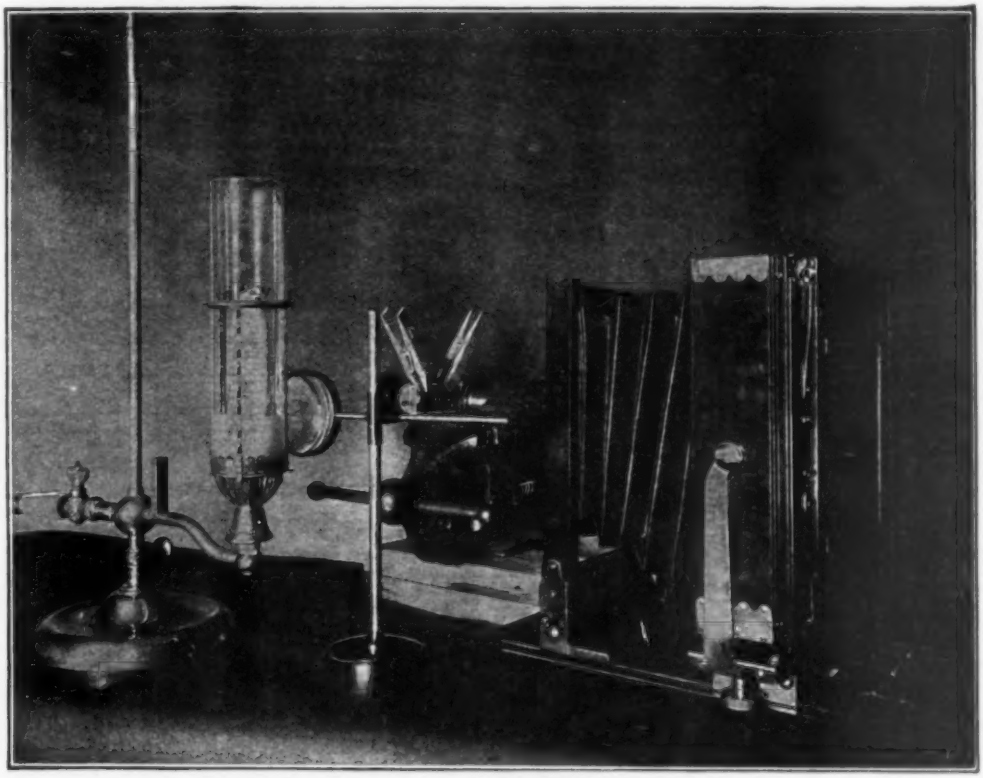
Head of a Gnat

At one end of the microscope is a lens—called the object lens or objective. It has, like all other lenses, a certain "focal length" or "focal distance"; or that is, it must be just so far from an object, in order to produce a clear picture on its other side for you to see or for the camera to see.

Now this focal distance varies with circumstances. The closer the lens is brought to the object, the further away the lens at the other end of the microscope, or the ground glass of the camera, must be, to keep the picture sharp. And as much greater as is the distance from lens to ground glass, than the distance of lens to object, so much larger than the object will the picture be.

For example, let us suppose we have a little five-dollar microscope, which when we try it, we find to be equipped with a lens which is of 1-in. focus; that is, between the lens and the object is a distance of one inch when we

can see it plainly and clearly through the eye end of the microscope. Now, suppose we unscrew this eye end lens



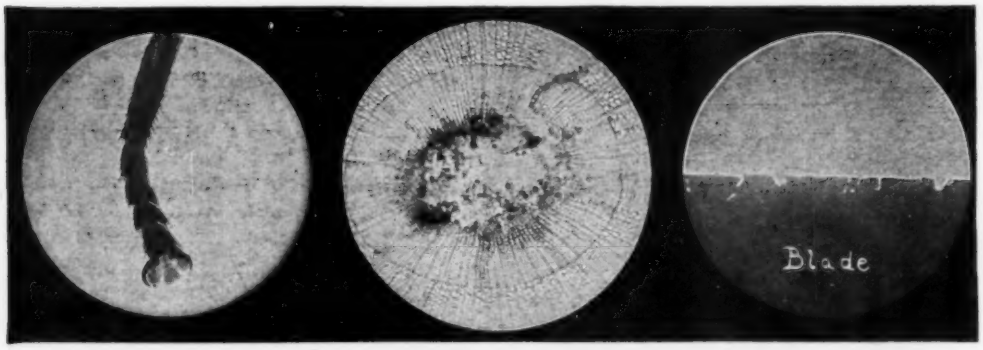
Arrangement of Camera and Small Microscope for Photo Micrography

and put a camera in place of it. If the distance between the lens and the plate of the camera is 10 in., and the distance between the lens and the object 1 in., then the picture we make will be 10 times bigger than the object. In other words, it will magnify 10 diameters or 100 times.

Obviously, the better the microscope and the better the lenses, the better the microscopic pictures. With a really fine instrument, such as scientists use in the laboratory and which cost several hundred dollars, pictures magnified 3,000 diameters or 9,000,000 times can be made! Of course this is the extreme—the very top-o-skill of making big pictures of little things. But, strange to say, to the beginner in microscopical research, the high magnifications are not as interesting as the low ones. That is, the average person is more interested in seeing a 10, 15, or 20-diameter picture of an insect part—a bee's sting, or a fly's tongue, or a butterfly's foot, than he is in seeing a very highly magnified "cell" from the body of an insect. In consequence, you need waste no wishes on the big and expensive instrument. If you have or can get a small five-dollar microscope —almost any kind of a camera without a lens—and are reasonably handy with a jack-knife, you can make some pictures which will make your friends sit up and take notice.

To begin with, you must make a light-tight joint between the microscope, which is to be used horizontally, and the camera. If the camera has a lens on it, take it off. Construct either a pasteboard tube, just big enough to slip over the end of the microscope, or a cloth tube the same size. Fasten this to the camera. Now put the camera

on a board and fasten it with a cord, or strap, or cleats—any way, so it is rigid. Next whittle out a couple of rests for the microscope, so it can be held horizontally. When I last made pictures with the smallest microscope I could find, I held it in a horizontal position by putting it in a vise, as in the picture.



Fly's Leg | Heart of a Twig | Poorly Sharpened Penknife

The next thing to do is to provide light by which to make the picture. Artificial light is much the best, because you can move it around and because it doesn't vary. An electric bulb is most convenient, but anything, even down to a candle, will do. As you can see in the picture, a welsbach gas lamp on a student lamp frame makes a good outfit. Besides the microscope, the camera, the light, and a plate, you will need something to photograph, and a bull's-eye lens, or a common reading glass.

Gnat's Wing Tip

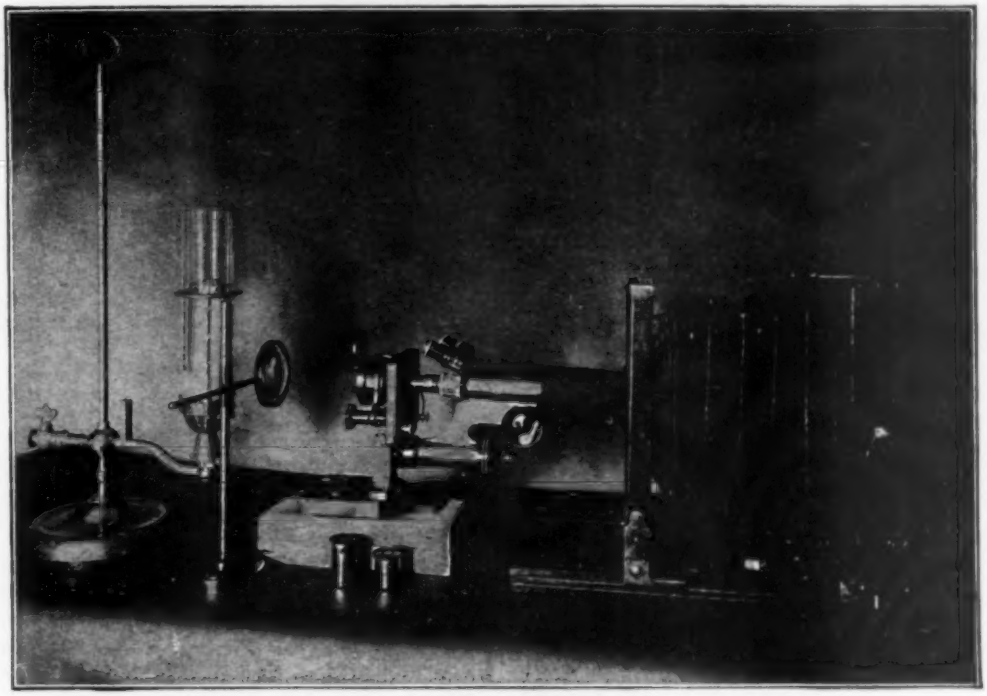
The thing to be photographed—let us suppose you have killed a fly and taken one of his wings and laid it on a clean slip of glass with a tiny drop of glue at the extreme edge to hold it still—is to be clamped on the "stage" of the miscroscope, as the flat place provided for these glass slips is called. The microscope, with all the eye-end lenses unscrewed and laid aside, is placed horizontally, and the camera connected to the empty tube of the microscope. Then, with your head under the focusing cloth, manipulate the mirror in the microscope and the light until you can see light on the ground glass of the camera. Next get the focus by pushing in or pulling out the tube of the microscope until the image is sharp.

Put in your plate holder, and after waiting a minute for vibrations to subside, make the exposure by pulling the plate holder slide. Exposures vary greatly with the color of objects and the light and magnification, but an attempt at half a minute is a good starter. The reading glass? It is to go between the light and mirror, to concentrate and make stronger the former, if the image on the ground glass is not strong enough.

This is photomicrography in its simplest form. But you will be delighted and surprised at the number of interesting pictures you can get. And until you have pictured some of the commoner things of life—such as

carpet hair, sand, sugar (sometimes found together), insect parts, skin, human hair, parts of plants, apple skin,

Put the little slip of glass holding the object to be photographed upright against a window pane, or hold it up-



Adaptation of Camera to Compound Microscope for Photomicrography

etc., etc., you will not know what pleasure the simple apparatus can give.

"But," you lament, "I have no five-dollar microscope!"

All right—we will make photomicrographs without one! Where there is a will, there is a way! You have a camera, but no microscope. Before, we combined a microscopic lens with an ordinary camera—now, having no microscope, we must combine an ordinary camera lens with an extraordinary camera!

If the microscope lens of 1-in. focus, gives a picture magnified 10 diameters with the camera plate 10 in. away, then a photographic lens of 5-in. focus should give the same result, if the plate is 50 in. away. So it will. All you have to do is make a box 50 in. long, put your camera lens on one end, and make the other end fit to the back of your camera so it can take a plate holder, and you are ready.

right in the vise. Throw the light through it into the camera lens with the illuminant and the reading glass. Focus carefully by moving the whole long box, camera that it is, lens and all, backwards and forwards, until the image is sharp. Put the plate holder in, and photograph as before.

Still another way there is—instead of buying a microscope buy a simple objective of say 1-in. focus, and fit it to your ordinary camera. All that you need to make pictures of 10, 12, or 15 diameters magnification, is—some sort of a dark box; some sort of a lens, the focus of which is 10, 12, or 15 times less than the distance from end to end of your camera, improvised or purchased; a light; an object; and some patience!

Development and printing of such pictures is just the same as with ordinary pictures, except that a good contrasty and glossy paper should be

used for making prints, as what you want is detail, not pictorial fussiness.

Do not infer that because I have spoken so much of the five-dollar microscope, I regard it as the best for any purpose. It is commonest, as a toy, or as a means of recreation; that is all. By all means, if you can afford it, get a better instrument. Good ones can be purchased for from $15 up, which are capable of doing some very fine work, and the equipment of which can be varied and added to from time to time.

The photomicrographs which illustrate this story were made in all possible ways, some with a fine outfit, some with the cheapest outfit, many with an average outfit.

HOTELS AS STORAGE HOUSES

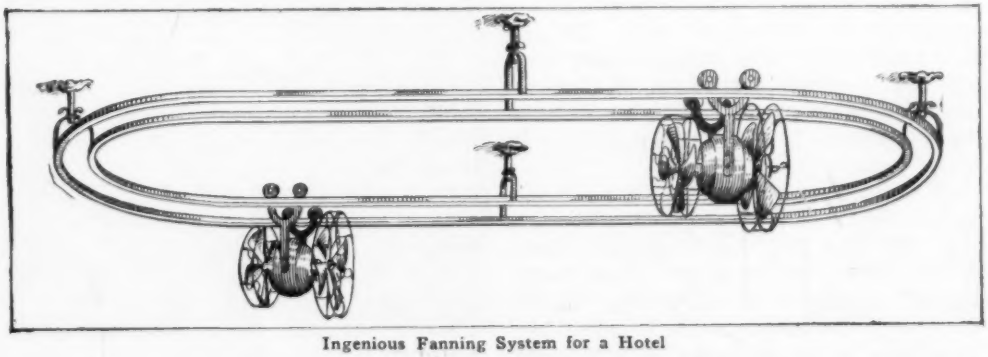
An extraordinary, but, according to the manager of a New York hotel, not uncommon way of imposing upon hotels is to register for a day and store baggage for months. A man entered the hotel in question not long ago and was followed by six trunks. He took a cheap room, occupied it a few minutes, and on the afternoon of the same day left for San Francisco, on his way to Japan and China. Apparently, his only object in stopping at the hotel was to store four of the six trunks cheaply during his absence. Another instance of the same kind came to light when a man arrived from Mexico and presented checks for three trunks he had left at the hotel the summer before.

SCREEN MASKS FOR RACING-AUTO DRIVERS

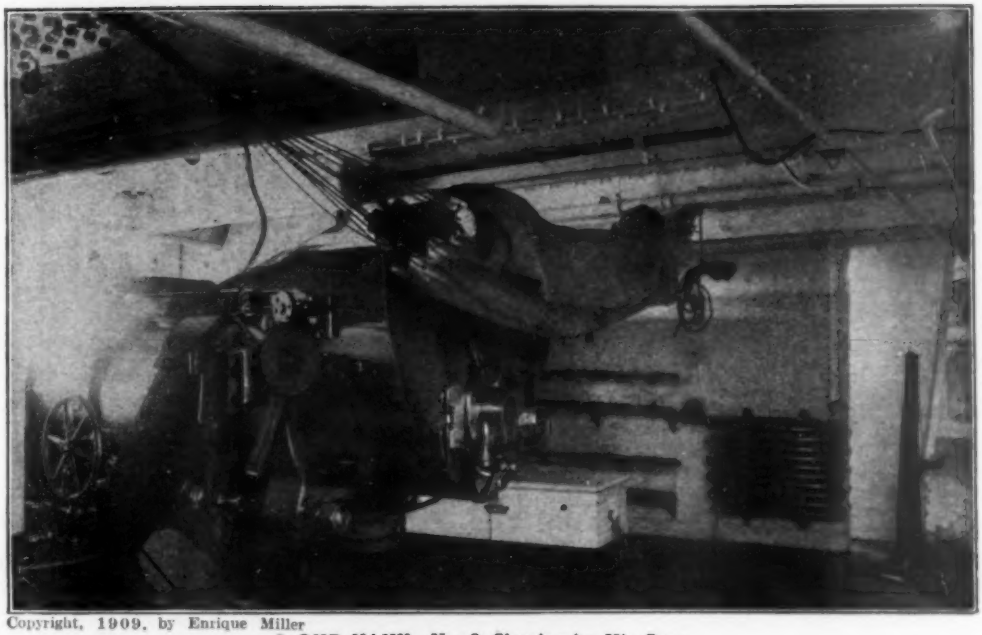
The curious shield shown in this illustration was worn by Lewis Steang, one of the drivers in the Cobe Cup automobile race of the Chicago Automobile club, held on the Crown Point, Ind., course in June. It is a circular screen which protects the face from the gravel thrown by cars he passes.

ELECTRIC FANS TRAVEL AROUND CEILING

A hotel electrician has designed a traveling fan which runs around the ceiling of a room and busily drives out the foul air. Two tracks are secured to a ceiling by means of hangers, and through them pass the negative and positive electrical currents. When the electricity is turned on, the tracks and the two fan motors which are hung from them become charged. Each motor carries two fans, one fan on each being smaller than the other. The blades of one fan being larger than the other will immediately start the device traveling around on its track, and, as the smaller fan works against the larger, the traveling speed, which otherwise would be very great, is held within limits.



Ingenious Fanning System for a Hotel



Copyright, 1909, by Enrique Miller

OUR NAVY—No. 2, Sleeping by His Guns

LONG STRUGGLE TO REACH ROCK SALT SUCCESSFUL

After ten years of labor, in which success and seeming defeat alternated, the graphic story of which was told in the April issue, the Detroit Salt Co., at an expense generally conceded to be more than $1,000,000, has succeeded in sinking a shaft through 1,000 ft. of silt, limestone, etc., to where large deposits of rock salt were known to exist. Seven lives were sacrificed in the search for wealth and many features hitherto unknown to the mining world, were incorporated in the work.

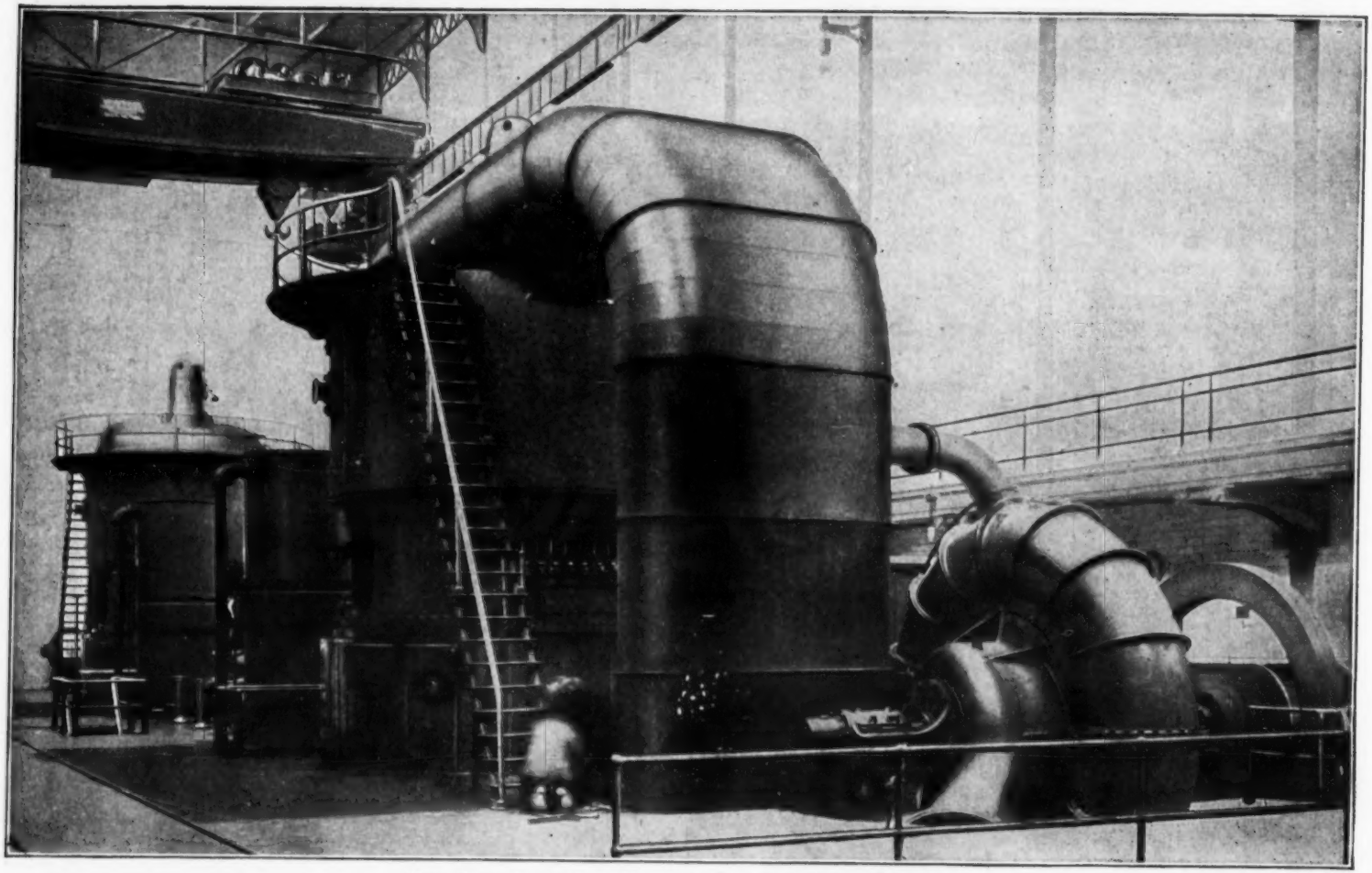
The most unique, and by long odds the most interesting, was the system invented by Engineer Bradt to shut out the sulphurous flow which poured through the porous limestone. The engineer spent many months of study on the problem and finally hit upon the idea of forcing cement into the porous rock. Several experiments proved the feasibility of the plan and after months of labor this reinforced process formed an effectual barrier to the water.

The rock salt is said to be one of the best ever discovered in this country. It is as clear as crystal and in some cases is 99 per cent pure. It will be mined after much the same fashion as coal and when brought to the surface will be screened. The Michigan mine is one of the four places on the American continent where rock salt is mined.

FENDERS FOR AUTOMOBILES

Spurred on by the number of fatalities in Chicago due to automobiles, members of the common council of that city started agitation in June to compel automobile owners to equip their machines with fenders. An unwieldy fender of the kind used on street cars is not contemplated, but some light fender that will be effective. A spring buffer, at least, that will protect people from the steel bar that runs around the front of most machines to save the lamps is desired. This bar is claimed to be one of the worst menaces of automobile construction.

During the first five months of 1909, 31 persons were killed in Chicago by automobiles and 641 injured.



More Power in an Hour Than a Man Can Furnish in a Lifetime

ELECTRIC PLANT HAS SIX 18,600-HP. TURBINE GENERATORS

The Commonwealth Edison Company has now partially completed in Chicago another great electric generating station the ultimate capacity of which will be 84,000 kw. as a sustained output, equivalent to 112,600 hp. This huge amount of power developed in one not extraordinarily large building is to be generated by six 18,600-hp. turbo-generators, two of which are now in operation while a couple more are nearing completion.

Any one of the great turbines taken alone does not give the impression of great force, but within is contained a mighty developing power. The output of electricity from one of them is equivalent to the work of lifting the U. S. battleship "Connecticut" bodily out of the water and to a height of 400 ft. above the surface in a period of one hour. It would provide for all the electric light and power service for two cities like St. Paul, and expressed in foot-pounds, it equals lifting 1 lb. 36,958,680,000 ft. high in 1 hour, or 18,479,340 tons 1 ft. high. If a laborer had commenced a task at the dawn of the Christian era, and were still working at it 8 hours a day, one of these generators would catch up with him in less than three days. No wonder this generation is living fast.

One of the great features of the plant is its ventilation and cooling system. The basement under the turbines is a free space open at one side of the building, and leading from this space to each turbine is a large metal duct through which air is carried by natural draft to the generating portions. Each turbine takes 48,000 cu. ft. of air per minute.

The boiler section of the station contains eight double-drum boilers for each turbine, 48 in all. Each set of eight will have a smokestack 12 ft. in diameter and 250 ft. high. The surface condenser for each turbine has 25,000 sq. ft. of cooling surface.

DEVICE FOR SMUGGLING INTOXICANTS

The device shown hanging at the side of the figure in the illustration is being adopted in parts of cities where some residents wish to buy their intoxicating beverages by the pail instead of by the bottle, yet do not wish to be seen carrying it home in that manner. Therefore it is made in a shape that will fit closely to the form and not show when the coat is closed over it. It is 10 in. high and on the handle is a double hook arrangement that is hung from the armpit or pocket of a vest.

WIRELESS PHONE EFFECTIVE 100 MILES

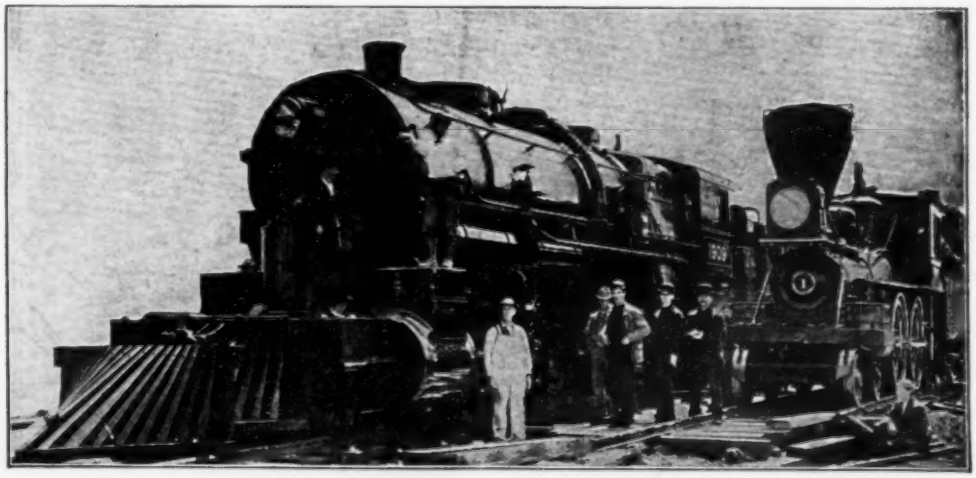
The trials of wireless telephone service between the French cruiser "Conde" and land stations are reported to have shown progress. On June 9 the cruiser was able to talk with a station 100 miles distant, and on previous days, 60 miles distant.

President Taft's automobiles are exempt from speed laws in the District of Columbia.

JAMES J. HILL CONTRASTS HIS OLDEST AND HIS NEWEST LOCOMOTIVE

By William Thornton Prosser

As showing the marvelous improvement in railway motive power in the last generation, and typifying in a way, the transformation of the Northwest of the late '60's into the Northwest of today, James J. Hill has placed on exhibition at the Alaska-Yukon-Pacific Exposition, in Seattle, the first locomotive to be operated on the progenitor of the present Great Northern Railway system, and alongside this out-of-date engine he has put the latest type of powerful locomotive, known as the Mallet, weighing almost ten times as much and having an efficiency even greater in proportion. Not less interesting than the contrast between these engines is the man in charge of the exhibit as the personal representative of Mr. Hill—Albion B. Smith, who at the termination of the Exposition will return to his cab as the oldest locomotive engineer in active service in the United States. "Number 1," as the small engine is known, seems almost the personal property of Engineer Smith, for he has ridden in its cab the greater part of the time since its arrival in St. Paul more than 40 years ago.



The "1909" Weighs Ten Times as Much as the "Crooks"

But the saucy-looking coffee pot locomotive has a more affectionate and endearing name than "Number 1." Its old friends of the early days know it entirely as the "William Crooks," the name given in honor of a civil engineer in the service of the St. Paul & Pacific, which was later extended to the Pacific Coast by Mr. Hill. Mr. Crooks, following his association with Mr. Hill, was chief engineer of the Oregon Railway & Navigation Company. For the last few years Engineer Smith has been operating on the Breckenridge division of the Great Northern, and today is so hearty and hale that he looks good for many more years of service, in spite of the seventy-one winters that have passed over his head.

The "Crooks" was built by Smith & Jackson, of Boston, Mass., in 1861. It weighs 55,400 lb. on its drivers. The diameter of its driving wheels is 63 in. Until 1868, it was operated without serious mishap on the St. Paul & Pacific, but in that year it suffered severely in a roundhouse fire, in St. Paul. Though in the early days it consumed wood, later it was converted into a coal burner, and today is in almost as good condition as in the beginning. It has made as high a speed

as 15 miles in 16 minutes, a record of which its captain is proud. Its hauling capacity has been tested up to 120,000 lb. on a level stretch.

It was following the roundhouse fire that Smith was employed to assist in the process of overhauling the "Crooks." From that time on he was the constant companion of the faithful engine for many years.

Many of the big Mallet type of engines are in use on the mountain divisions of the Great Northern, through Montana, Idaho and Washington. The engine of the "1909," as the A.-Y.-P. locomotive is known, weighs slightly more than half a million pounds, with its tender. Its design includes two high and two low-pressure cylinders. The diameter of the drive wheels is 55 in., while the tender will carry 13 tons of coal at one loading. The Mallet will haul 1,600 tons of freight on a 1 per cent grade. In the Cascade mountains two engines of a somewhat older pattern were required to move 1,050 tons of freight; now two Mallets negotiate the heavy grades with 1,600 tons, and consume no more fuel.

When Mr. Hill gave his famous birthday dinner, at his three-score-and-tenth milepost, he made up a train that was hauled from St. Paul to Lake Minnetonka by the "William Crooks," all resplendent in new paint and freshly polished brass trimmings. The guests at the dinner party were employes of the Great Northern who had been in the service of the company for 20 years or more. Engineer Smith, who had spent the greater part of his life with Mr. Hill, operated the "Crooks" on that memorable trip, and his fireman was another veteran of the rail.

"I understand you're going to dump 'Number 1' in the scrap heap pretty soon," said Engineer Smith to his grizzled chief at that dinner.

"Not while I'm around; the 'William Crooks' will last as long as I do," was the response.

The University of Paris has received endowments of $240,000 with which to promote aviation.

SAN FRANCISCO GETS THE "GJOA"

The photograph shows the famous sloop "Gjoa" lying along the Independence dock at Mare Island, Cal. In it,

Now One of San Francisco's Sights

Capt. Roald Amundsen made the first and only trip that has ever been made through the Northwest Passage. This passage had been unsuccessfully sought for since 1497.

Capt. Amundsen set out from Christiania, Norway, on June 16, 1903, and arrived at San Francisco on Oct. 19, 1906, having passed through perils of fire, reefs and fierce Arctic storms. The vessel was built in 1872, is 70 ft. long with a 20-ft. beam, and has a dead weight of 134 tons. She is equipped with a 2-cylinder oil engine of about 30 hp. She has recently been presented to the Golden Gate Park of San Francisco and will be placed in it.

BURIAL OF CHINA'S EMPEROR

On May 1, after his body had lain in state in the royal palace for five months while prayers were being chanted day and night, China's emperor was borne to his tomb in a great catafalque or funeral car, weighing a little more than

The Emperor's Funeral Car Weighed More Than 3,500 Lb.

3,500 lb. Its frame was composed of great beams, painted yellow, and over this was a hood draped with yellow fabric which also covered the sides. Within this was placed the body in a coffin of rare woods, and the whole was carried by 200 coolies, garbed in gray hats with yellow plumes, and in light red gowns. A framework of many long poles supported the funeral car and this rested on the shoulders of the coolies, as shown in the illustration.

A person who has an affected lung is spoken of as a "one-lunger," because he has practically only one lung. Automobiles with but one cylinder are called "one-lungers" for the same reason.

PERMANENT HOMES FOR AMERICAN AMBASSADORS

In the last decade extraordinary changes have been effected in the relations of the United States with foreign governments and the question of housing embassies in a manner consistent with America's position as a world power has become so urgent that an association of representative Americans at home and abroad has been organized to try to better matters. The task of the association will be to concentrate public sentiment and obtain favorable action by congress in the acquisition by the United States of permanent homes for its ambassadors.

It is conceded everywhere that at present none but the very rich can pay the rentals of homes suitable to the dignity of an American ambassador in the capitals of Europe. Throughout the country, men who would grace the office of ambassador or minister, and who, in such high posts would reflect great credit on the entire nation, are debarred because their fortunes are in-

adequate to meet expenses that should be, but are not, borne by the government, because congress will not countenance it.

The association believes that refusal to at least provide proper residences for America's representatives abroad is false economy. An ambassador, to reflect upon America the credit she deserves, must keep up an equal appearance with other foreign ambassadors, nearly all of whom are provided with permanent homes by their governments, and receive salaries and expense appropriations almost ten times as great as that allowed by the United States. The cry is continually heard that no one but a rich man is ever selected to fill a high post abroad, yet the people who raise this cry are among those who are preventing, through an insufficient provision, the sending of men who, while lacking in wealth, are great in mentality.

GERMANY'S NEW "DREADNOUGHTS"

The dimensions of the four new German "Dreadnoughts," the "Nassau," "Westfalen," "Rheinland," and "Posen," concerning which the strictest secrecy was maintained, are as follows: Length, 450 ft.; breadth of beam, 88 ft., 10 in.; displacement, 18,500 tons; speed, 23 miles; armament, twelve 11-in. guns, twelve 5-in. guns; sixteen 3½-in guns, and six torpedo tubes.

STEEL PILE DRIVER HAS MANY FEATURES

The railroad pile driver shown in this illustration has many new and interesting features, among which are: an ingenious set of lifting cylinders that raise it in its entirety clear of the tracks, its ability to travel at good speed without the assistance of a separate locomotive, and its all-steel construction.

The turntable, or lifting cylinders, that enables the machine to be raised and turned end for end is hung from the center of the car body, and is entirely independent of the other mechanism. It consists of steel casting ball races about 5 ft. in diameter supplied with large steel balls to form an anti-friction bearing. The lower ball race is equipped with jack screws at the 4 corners, and base castings to take the weight from the rails. The upper ball race is suspended from the car body by a system of powerful parallel levers operated by hydraulic lifting cylinders, receiving pressure from the boiler feed pump. These lifting cylinders push the turntable down

Wheels and All Are Lifted from the Tracks and Swung

upon the track and then lift the entire machine, including trucks, clear of the rails. A swinging gear is provided by which 4 men can then turn the pile driver end for end, lowering it upon the rails again by merely releasing the water from the lifting cylinders. This operation takes only 10 minutes, and when the turntable is not in use it is lifted 7 in. clear of the rails and held in place by safety retaining pins. When the machine is raised upon the turntable, the stability is such that, standing crosswise of the track, the leaders may be run up and down, and a pile picked up, located, and driven at any point 33 ft. or less from the center of the track.

The machine is provided with a large locomotive-type boiler, and powerful double-cylinder engines. These furnish sufficient steam capacity and engine power to propel 300 tons, including the weight of the machine itself, up light grades at a speed of 15 miles an hour, or 200 tons up a 1¼ grade at 10 miles an hour.

The leaders, which may be used either for drop hammer or steam hammer, are all steel, 40 ft. long, built up of 8-in. channels and plates, with the necessary connecting yokes. The drop hammer used weighs 3,500 lb.

A baker of Cherokee, Okla., was discovered selling loaves of bread in which flasks of whisky were secreted.

A CUBIC MILE OF SEA WATER

Contains Values Amounting to More Than Two Billion Dollars

By F. E. Mariner

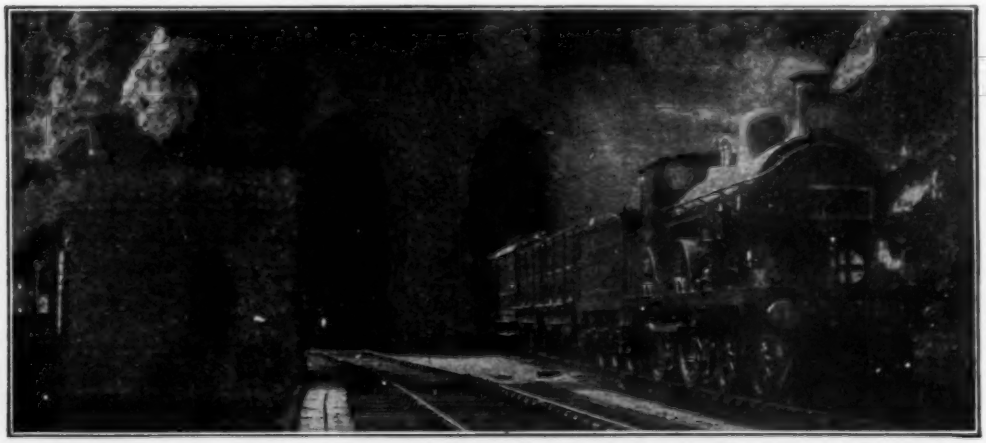
Few people even among scientists have any conception of the contents of a cubic mile of sea water. It contains 146,197,952,000 cu. ft.

To start with, this body of water weighs 4,460,544,000 tons and of this weight three and one-half per cent is solids comprising chloride of sodium or common salt, magnesium chloride, potassium chloride, sulphate of lime, sulphate of magnesium, sodium bromide and many other minerals in smaller quantities, not the least of which, in point of value, is gold.

The value of these minerals is so great that the contents of a cubic mile of sea water would be sufficient to pay our national debt, and leave a tidy balance. The gold content alone amounts to $178,421,700, and is based on the well known fact that a ton of sea water contains approximately one grain of gold.

The chloride of sodium or common salt contained amounts to the considerable quantity of 117,089,280 tons, and at a value of $5 per ton would be worth $585,446,400.

The magnesium chloride amounts to 14,050,713 tons and has a value of approximately $280,000,000. The potas-



Boat Express on the South Eastern & Chatham Railway, England, Emerging from the Shakespeare Cliff Tunnel

sium chloride weighs 5,520,285 tons and has a value of some $220,811,400.

This body of water contains in solution 7,181,475 tons of sulphate of lime or gypsum, of an approximate value of $20,000,000.

Last, but not least in point of value among the principal minerals contained, is the bromide of sodium of which there is 1,717,209 tons with a commercial value of approximately $858,604,500.

The total value of the minerals enumerated amounts to $2,143,484,000. When we consider that the globe's surface is two-thirds sea, and that the average depth is a trifle under two miles, some slight conception creeps into one's mind of the enormous stores of minerals held in solution.

From a small boat, situated in average depth of water, there is within the very limited horizon enough ocean surface containing values to pay the national debts of the world, and have left over many times the value in gold of the storage vaults of the world which are the accumulations of ages.

The values taken are representative of the market values of the materials as handled in ordinary commercial transactions. It is quite obvious that were such enormous quantities of materials as above mentioned available for sale, the contents of a single cubic mile of sea water would glut the markets of the world for a long period.

Fig. 1

Fig. 2

Fig. 3

WIRELESS MESSAGES TRANSMITTED WITHOUT A GROUND

The sending of wireless messages through space without a ground at either station has been demonstrated by two inventors of Brooklyn, N. Y., Messrs. I. Wolff and H. Mohler, where they took part in the Memorial Day parade with their complete sending and receiving stations mounted on bicycles. One of the inventors took the position at the end of the procession while the other was leading, making a distance of about 1½ miles between them. No ground wire was used and the rubber tires prevented any connection through the frame and wheels.

The sending apparatus of the station on the bicycle consisted of a 2-in. induction coil, a zinc spark gap, a homemade rubber plate multiple-series condenser, which was used for the transmission of the electrical waves, and a large wireless key that operated the coil. The receiving instruments consisted of a pair of 3,000-ohm double-head telephone receivers, a silicon detector and a noninductive potentiometer. The entire outfit, including

the battery, was mounted on a board 10 by 22 in. which was fastened to the handle bar of the bicycle as shown in the photographs. Figure 1 shows the receiving, and Figure 2 the sending station.

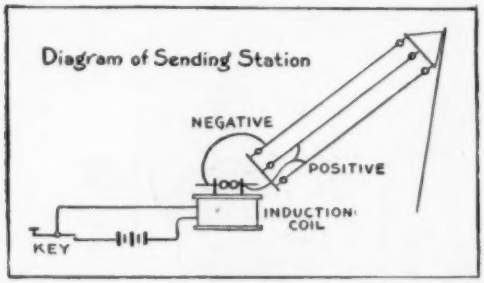


Fig. 4

tion. In Figure 3 is shown the location of the batteries and after placing the instruments on top, the whole was covered with the American flag. The aerial consisted of a three-wire system mounted on a 7-ft. pole, which was attached to the seat of the bicycle. Each of the three wires are 10 ft. long and insulated at the top and bottom.

The transmitting and receiving instruments were connected with very heavy rubber-insulated wire. The operator would guide the bicycle with one hand and work the key with the other. The interesting part of this outfit was the aerial used for sending the electrical discharges. The wires were divided into two parts; one part consisted of two wires connected to the positive terminal of the induction coil, while the other, or single wire, was

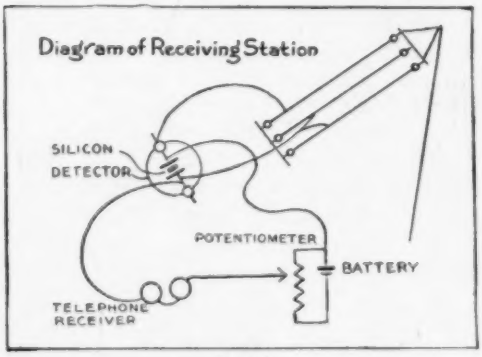


Fig. 5

connected to the negative. The diagram of the sending station is shown in Figure 4 and that of the receiving station in Figure 5. In both diagrams A represents the top of the aerial and B the bottom.

THE ENGINEERING STAFF OF A GREAT LINER

The engineering staff of a great trans-Atlantic liner is in excess of any other department, the crew of one of the fast ships having 70 men in the deck department, 350 in the steward department, and 380 in the engine department. Yet the men who have to do with the mighty power that sends the ship forward on its trip across the ocean are the least heard of or seen.

The crew under the chief engineer are divided into three watches, each watch having 4 hours on duty and 8 hours off duty. The chief engineer is held responsible for all the machinery on board, which, apart from the main engines, includes windlass gear for heaving the anchors; capstans, warping engines, winches and steering gear, refrigerating and condensing plant, air, circulating, feed, fresh water, sanitary and other pumps, and miles of piping of all sizes. The electric plant alone is capable of supplying sufficient power for a city of 20,000 inhabitants.

But the engines around which all interest centers are the great turbines that furnish the power to drive the ship. A twin-screw, 28,000-hp. reciprocating engine requires 22 engineers, while the present-day 70,000-hp., the largest plant afloat, requires 31 engineers. "Again," says the Marine Review, "supposing reciprocating engines developing the same horsepower were used, the lubrication for the internal rubbing surfaces would have to be used in such quantities that it would be a great danger to the heating surfaces of the boilers. Such a plant on board ship would be impossible to run with the minimum of risk of the turbine."

In 1908 a sum equal to 48 per cent of the total earnings of the Pennsylvania Railroad, or $125,543,947, was paid out in wages.

EDITORIAL

Standard Oil is generally conceded to possess the earth, or at least a very large portion, and now it is reported to covet the fatness thereof. According to the newspapers the company's chemists have discovered a process by which a new by-product is to remain after taking out a long list of other valuable commodities. This new product, as yet nameless, is to be served out as butter. However efficacious grease may be on automobile gears, and vaseline for chapped hands, there is small prospect that any considerable number of people will want to anoint their insides with mineral oil under the guise of food.

* * *

At this writing (July 9) our medal-decorated aviators have not made the flight which is to win the Government prize of $25,000. The President, members of his cabinet, stately senators and ambitious congressmen have made the dusty pilgrimage to Ft. Myer thus far in vain. The Wrights, according to their established policy, refuse to be influenced by impatient crowds or expectant officials, and decline to make the real flight until they "are good and ready."

One day it threatened rain, the next it did rain; on other days the wind was not where it should be, or there was too much; again, the spark plug mutinied, and so on. On July 2nd, Orville Wright made a short flight, but something slipped a cog and the machine ducked and broke a wing. Orville was obliged to go home to Dayton for a piece of new cloth to repair the damage.

Far be it from us to belittle the achievements of our fellow Americans who have been honored so signally by European royalty and the American Congress. But it is impossible to shut our eyes to the fact that, to date, the aeroplane as an instrument of warfare is about as dangerous as a turtle. True, it is in its swaddling clothes, and there are great hopes for its effectiveness when it graduates into a full suit of khaki and a belt.

It is evident that much—very much—remains unsolved before the aeroplane can be included in the machinery of war, the first requirement of which is dependability under all conditions. Conflicting armies and navies cannot wait for favorable weather conditions.

The dirigible has now reached a point where it could perform some actual service, although it, too, has more to fear from a stiff wind than from the bullets of a foe; the aeroplane in time will doubtless become immune to some of its present impediments.

Is it not quite possible that actuated by a new danger, the very newness of it has attributed to aircraft a larger degree of destructiveness than is likely to result? International agreement will certainly bar from civilized conflict the dropping of explosives upon a city. The chance of hitting a battleship or fort with a shell dropped from any airship at an elevation beyond gun fire on the surface, is so remote as not to be compared to the danger of a battleship from submarine torpedoes.

* * *

A most remarkable exodus has recently been accomplished, in the moving of 100,000 men, women and children from the shores of Lake Victoria, Africa, to places of safety many miles away. The occasion of the emigration was the ravages of the tsetse fly whose bite causes the fatal sleeping sickness. For eight years medical scientists have grappled in vain with the problem which still remains unsolved. In the meantime 200,000 victims have perished.

It is no easy matter to separate a people from the homes of its ancestors. The tenacity with which humans cling to the associations of a lifetime, even in the face of acknowledged peril, has been illustrated time and again. In the case of the natives of Uganda, the efforts of a white race to move a black increased the difficulties. England could have marched them out at the point of bayonets, and would have rendered the natives a great service in doing so. Such a proceeding,

however, would have meant war. Instead, for months, a systematic course of public instruction was employed until people were educated to the point where they wanted to go.

We should not lose sight of the fact that our own common house fly also slays its tens of thousands. Because the disease it spreads is not confined to one ailment, and that of so mysterious and spectacular a character, we fail to realize the necessity to protect ourselves from our own pest whose very numbers and commonness blind us to its dangers.

* * *

The ice shortage of last winter attracted unusual attention to the artificial production of a commodity which has become a household necessity. While the natural ice accomplishes a larger measure of results than an equal weight of the machine-made article, and the cost of manufacture is in the winter but little greater than that of cutting, housing, and shipping, yet there are some advantages in favor of the latter.

As population increases, ponds and lakes become more and more polluted each year with a corresponding risk of contaminating the ice cut from such places. In our large cities boards of health are constantly on the watch to prevent the distribution for purposes other than refrigeration, of ice containing typhoid and other infectious germs. The public seldom hear of this work, and thousands through ignorance are regardless of consequences; nevertheless the unmentioned men in city laboratories where ice samples are constantly analyzed and inspected, are saving hundreds of lives where the men of the beach patrol rescue one.

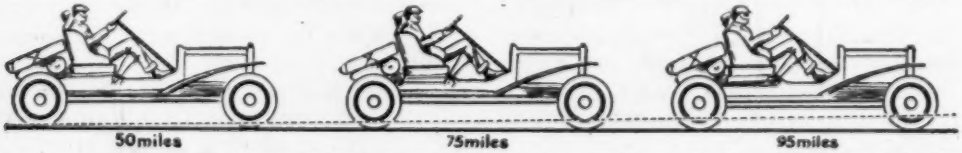
H. H. WINDSOR.

EFFECT OF SPEED ON TIRE PRESSURES

"It is a matter of common knowledge to the drivers of racing automobiles," says C. B. Hayward in an article in Automobile, "that a puncture is seldom or ever felt at the moment it occurs when driving at a high speed on a straightaway. Hemery, winner of the 1905 Vanderbilt Cup race, was not aware of the puncture which nearly cost him the race until the lateral weakness of the tire made itself felt upon rounding a curve three or four miles beyond where the puncture must have occurred."

Centrifugal force, the writer claims, is the factor that makes this possible; that prevents a punctured tire from collapsing under the terrific pounding it receives. It is a well established principle that a body acting under the influence of centrifugal force tends to leave the source of that force at a tangent and to progress in a straight line. The average road supplies an unending series of tangents along which the car flying at high speed tends to travel, and would follow, were it not that the superior attraction of gravity makes it adhere to the actual contour of the road surface. The wheels, turning at high speed, supply sources of centrifugal force at four points; the terrific inertia of the swiftly moving ton of metal tends to overcome the attraction of gravity, and the machine bridges gaps which at lower speeds would be followed in outline. The tires are relieved of the tremendous external pressure they have to bear at lower speeds, and while the internal pressure is more than sufficient to insure the hasty exit of the air, the tire does not collapse.

The illustration shows the tangent to the surface of the earth which the cars tend to follow at various rates of speed.



THE MAKING OF MOVING PICTURE FILMS

By Monte M. Katterjohn

Meteoric in its dash from oblivion, the moving picture industry has solidly established itself on the plane of permanency. From a novelty, the motion picture has found a definite place of unusual value to every science and an avenue of pleasure for the amusement loving world. The ever increasing popularity of the business of manufacturing films for projection, as well as its many appurtenances, has come to figure prominently in the industrial world.

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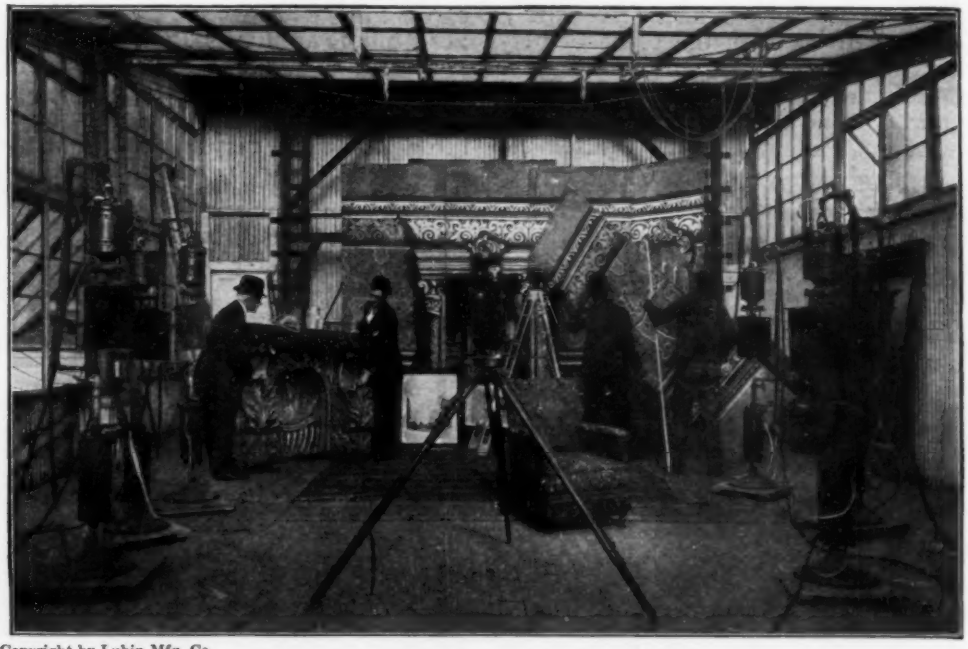
Making Exposures for Moving Picture Play

The projection of motion pictures is an easy matter, requiring only a steady head and a pair of alert eyes. The preparing of the film for the projecting machine is quite difficult and laborious. In motion picture parlance, the term "film" means a strip of celluloid 1⅜ in. wide and .005 of an inch thick, one surface of which is covered with a sensitized photographic emulsion for recording the picture in the camera. Negative film is used in photographing and after this is developed, positive prints are made from this negative.

Negative and positive films are put through about the same process in the making as is used in regular photography. The amount of film required in making a picture will vary from 60 to 75 ft. per minute according to the light conditions under which it is taken. The total length will run from 50 to 3,000 ft., according to the subject covered.

Every feature of the regular theater finds its counterpart in the huge glass studio of the moving picture company. The producers have a stock company of 20 or 30 actors whose names never appear on a program, but whose pro-

ductions are witnessed by some million people daily. In addition there are regular stage managers, producers, dramatists, carpenters, artists, electricians and the "prop" boys. For some subjects, special scenery must be painted, or a unique room must be constructed and both the artist and the stage carpenter are used. Also the lighting effects must be different or unusual in other subjects and the electrician must show his ability. And while these people are performing their duties, the actors and actresses are going through motions that are being recorded in the camera, the rate being 16 pictures to the foot.



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Shifting Scenery in Daylight Studio for the Next Production

In a dark room in the laboratory of the moving picture plant, the film as it is received by the picture manufacturer from the maker, is first perforated. Only the glow of ruby lights enable the operators of the perforating machines to watch their work. Small holes are stamped through the small strip of celluloid near the edges in order that it may be wound over a cog in the camera, likewise in the printing machine and last, upon the projecting machine.

To assure success in the end, absolute cleanliness is had in the making of exposures, and previous to the placing of the roll of film in the camera, every particle of dust is eliminated. Particular attention has already been given the film, which the camera operator endeavors to keep perfectly clean and smooth. The very smallest grain of sand will mean a pin head in the film, and when projected on the curtain is a thousand times as large, making an ugly blur.

While the operator is handling the camera and the actors are going through their parts at the command of the stage director, the electrician is busied in keeping the light steady, or making the shadows. If any of you have ever witnessed "The Gentleman Burglar," you should recall the scene in the dive when the gentleman burglar killed his pal. Just previous to the time of the firing of the fatal shot, the electrician plunged the studio in total darkness, immediately throwing the

light in the face of the murderer, showing him cool and calm, lighting a cigarette, and then, as quickly as the lights were flashed off, they were flashed on.

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Perforating Moving Picture Films

Also in the making of war scenes, which necessitate outdoor photography, the effects must be secured in a queer way. The bombs which one sees come bounding along are nothing but small charges of powder with extra long fuse, but it gives the effect, makes the smoke, and the actors have orders to dash through the smoke, to scream and such, all of which goes to display the horrible truths of war.

From the camera the exposed film is taken to the laboratory, in which the dark room is located. There, under the glow of ruby lamps, the sensitized celluloid is wound on huge drums and

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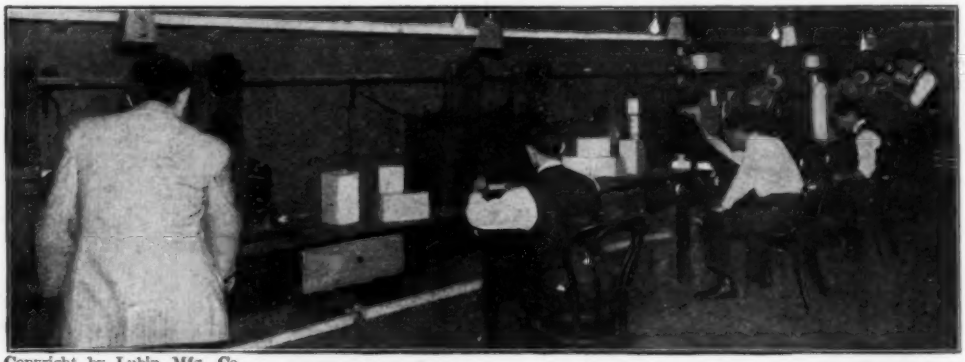
The Developing, Toning, and Drying Room

then lifted into vats of developer and other solutions. The drums are revolved through successive baths of developing, washing, fixing and final washing solutions. After having passed through the different acid mixtures and water washes, the film is wound on a drying drum, edge to edge, and is secured taut with push pins. The film is allowed to dry spontaneously or by rapid revolution of the drum, being governed by the lateness of the issue.



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Printing the Positives by Machinery

When the negative is thoroughly dry, it is taken to a printing room and the positives are printed by machinery. Both the negative and the blank film are placed in the machine and when both are lying together, perfectly flat, in the same fashion that printing paper must lie against the plate, they are passed over a strong light and the positive is exposed. The negative is exposed as high as 150 times, that many positives being made. The positive is subjected to practically the same treatment in the way of being developed as was the negative. Following the drying of the positives, they are sometimes tinted or hand colored.

In the making of many trick films, sections of pictures are cut out to heighten action. For instance, the camera operator makes an exposure of a number of men building a house. When certain sections are cut out of the negative, and the remaining parts glued together in order again, it appears to the observer that the house is built in ten minutes, or whatever time is usurped in showing the picture. Weather-boarding is put on at lightning speed, nails are driven home at a blow and the details are reproduced more rapidly than they ever could possibly have occurred. By reversing the film, horses can be made to gallop backwards, and men can be shown jumping backward over high walls.

To some the concluding statement may be trite matter, but at any rate it is proof of the above. To stage a subject the expense runs from nominal figures to thousands of dollars. Pathe Brothers of France are said to have spent nearly $20,000 to produce the "Passion Play," and record is made of a Russian firm paying $27,000 for two performances given by the noted star, Chialpone. American firms have spent fortunes in securing interesting picture effects, and it seems that no undertaking is too big or too hazardous to stop the daring motion picture promoters.

PHOTOGRAPH OF WILL ACCEPTED IN COURT

A precedent was recently made in the district supreme court at Washington by the acceptance of the photograph of a will, instead of the will itself, for probate. The will was that of Mrs. Frances von Bredow, daughter of Senator Newlands, of Nevada. Mrs. Bredow died in Germany, and her husband, Leopold von Bredow, finding that the will would be held up in the Berlin courts and he could not send it to this country, caused it to be photographed.

PRESS COMMENTS

During the month of April the fire loss in the United States amounted to more than $19,000,000. Only an extremely rich nation could afford to burn up every year more than some fairly prosperous nations produce.—Galveston News.

Will the new American "Dreadnoughts" sink, swim, and fly?—Washington Post.

The incident of an equine being hauled out of the mud by a motor car on a New York electric road shows there are other things besides money that will "make the mare go."—Seattle Post-Intelligencer.

Man with his limitations may not hope to know the side of a woman's hat front, and he sometimes believes even the women must guess at it.—Atchison Globe.

Saul has slain his thousands, David his tens of thousands, but Roosevelt has shot up all Mombasaland.—Baltimore News.

Future warfare probably will evolve aeroplane destroyers, and these will be followed speedily by destroyers of aeroplane destroyers, which in turn will be followed by other destructive agencies that obviously cannot be mentioned here on account of a lack of space.—Chicago Tribune.

"No one need blow or brag about noiseless guns," said one of the boys, "we've got that skinned with our noiseless talk."—The Mirror (Minnesota State Penitentiary).

BAMBOO BEDS FOR BURMA BABIES

The bamboo construction shown in this illustration was made by Lewis B. Rogers, an American resident of Toungoo, Burma, India, for a small member of his family. The bed is made entirely of bamboo, the floor being constructed of pieces split open, some of which are more than a foot wide.

Bamboo suffices in Burma for almost anything wood can be used for, such as water buckets, drinking cups, etc., as well as for the building of homes.

Baby Crib Made of Bamboo

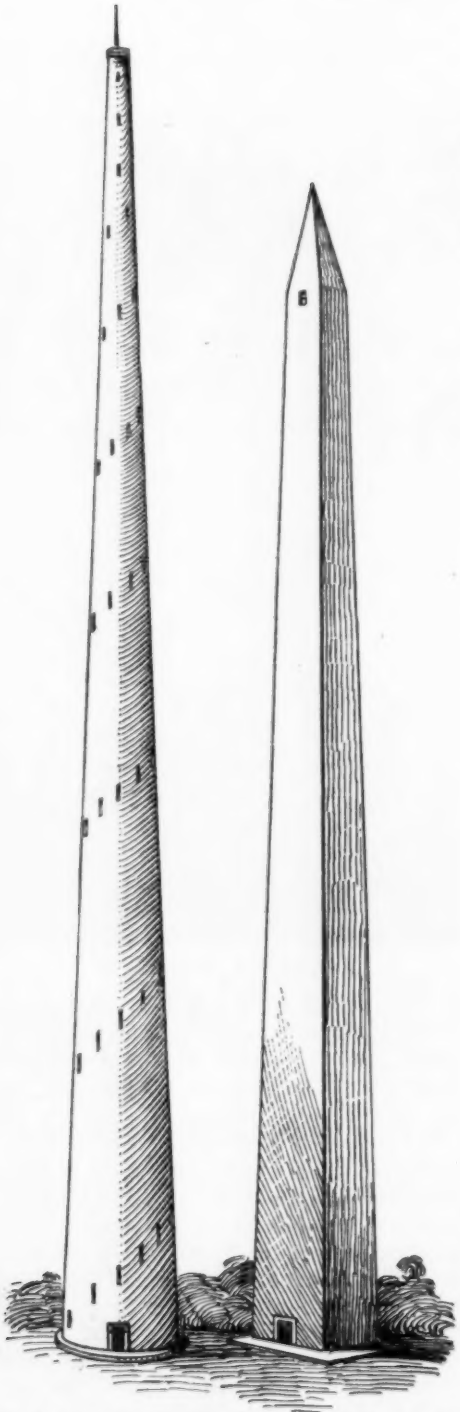
NATURAL-GROWN WOODEN BEAR

The natural-grown wooden bear shown in this illustration was part of a tree felled in a yard at Seabrook, New Hampshire. The only artificial parts are the chalk marks for teeth, and two white buttons for eyes.

A "Nature Fake" Bear

OVER AFRICA BY BALLOON

A trip over Africa by balloon has been the theme of many books of adventure and has been attempted more than once, but the first trip of the kind in recent years is now being fitted out by a Chicago publisher who proposes to float over the territory in which Theodore Roosevelt is hunting. The expedition is in reality one of photography, the idea being to gather rare mid-air pictures of animal herds.



Concrete Wireless Tower and Washington Monument, Showing Difference in Height

U. S. NAVY TO BUILD WIRELESS STATION 600 FT. HIGH

By L. W. Thavis

The United States Navy Department will soon let out bids for the erection of the tallest wireless telegraph station in the world. It will be located near Washington, and will be one of the most modern and powerful stations in the country.

Shooting up into the air to a distance of 600 ft., 45 ft. taller than the Washington Monument, and only shorter than Eiffel tower, of Paris, and two structures in New York City, the new tower will indeed be a marvel in construction and wireless communication.

The tower will be of concrete, according to a prominent naval officer. This was determined upon after a thorough investigation of other building materials. Steel lattice work and brick were considered, but their cost was found to be too much. The tower will be concrete with steel reinforcements. It will measure from 50 to 60 ft. at the base, and from 8 to 10 ft. at the apex.

At the apex will be a long slender wooden pole, not unlike a flagpole. From the top of this pole, a wire or steel umbrella-shaped frame will be erected for the purpose of attaching wires which will run to the station on the ground floor of the tower.

When once the work is started it will take more than six months to complete it. All the work will be done from the inside and by the day. The concrete, experts say, will not have to stand a day or two before setting or hardening, but on the contrary, work can be pursued each day. Concrete will last longer than either brick or steel and is much cheaper. Of the three materials of construction, steel lattice would be the most expensive, and brick would last the shortest period of time.

The most powerful wireless machinery in the world will be installed in the tower. This machinery will cost in the neighborhood of $100,000.

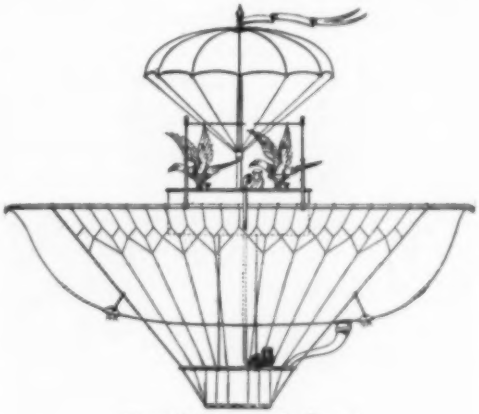
The tower will cost between $60,000 and $80,000. When completed the Navy department will be able to send a message from Washington to within a short distance of the shore of Africa, and to within a few miles of the Spanish and English Coast.

At the present time there are no wireless stations in the United States which will carry a message more than 2,500 miles. Most of the large types of battleships are equipped with wireless apparatus capable of transmitting and receiving messages to a distance of 2,500 miles. With the new tower working, it will be possible to send messages any distances up to the maximum. While wireless stations in this country are capable of sending messages 2,500 miles, it is most difficult at times to do so clearly and successfully. The firms who have submitted figures to furnish the machinery for the new tower, state they will guarantee the same to fill all specifications, which will call for 3,000 miles.

Rock Creek Park, Washington's most famous natural ledge, will probably be the site selected for the erection of the new tower. While many other sites have been considered, the park seems the most logical from an elevation standpoint. The Navy department officials are hopeful of having the work completed by next spring in order that they may commence extensive experiments now in contemplation.

CURIOUS INVENTIONS

Unique Flying Machine.—In these days of successful flying machines it is interesting to note some of the curious methods of aerial navigation heretofore proposed. In United States patent granted May 17, 1887, to C. R. E. Wulff, and now expired, was shown a new use for the American eagle. Instead of being allowed to pose in lofty independence as our patriotic emblem, this utilitarian inventor has put him to work. A team of live eagles, each hitched up in special harness, was connected to a balloon as shown in the illustration, and formed a means of controlling and directing the flight of the balloon. This motive power was capable of indefinite radius of action and all the aeronaut had to do was to



Propelled by Eagle Power

keep his team of eagles headed in the direction he wanted to go, which was done by a turntable arrangement to which the eagles were secured by their harness. The inventor in this case was a Frenchman and his invention was patented in France before it was patented in the United States. This may account for his lack of respect to our national bird.

An Odd Fire Escape was the subject of another invention, long in theory but short in practical results. A headstall for a man's head was attached to a parachute and shoes with thick elastic soles were applied to his feet, so that the wearer might jump from a burning building and alight with safety. The parachute held him right side up and retarded his descent and the elastic shoe pads cush-

ioned the impact on the ground. This invention was patented Nov. 18, 1879, by B. B. Oppenheimer, and it is now public property by the expiration of the patent and anyone can make and use it without fear of infringement.

MAKER OF MINIATURE MOUNTAINEERS

It would be difficult for a tourist to pass through any small town or village

Souvenir of a Mountain Town

of Europe without being offered some quaint piece of handiwork of one of the villagers, but it is seldom in this country that the women do such work and offer it for sale to people who happen to pass through. In a little town among the mountains of the South, however, a woman makes her pin money by making little figures of mountaineers, one of which is shown in the illustration. It is made of the most primitive materials and is about 6 in. high. The body is of twigs put together with tiny nails, the feet are of flat pieces of wood covered with red clay, and the head and hands are cut from dried apples, the color and wrinkles of which are curiously like that of aged faces. The hair is a bit of natural cotton, and the eyes are white beans dotted with ink.—Contributed by Mrs. E. D. Griffin.

A FEW POINTERS ON PURE AIR FOR WORKERS

By C. M Ripley

Perfect ventilation in a shop or factory, as under all other conditions, means that every person in a room should take into his lungs at each respiration, air of the same composition as that surrounding the building, no part of which has recently been in his own lungs or those of his neighbors, or which consists of the products of combustion generated in the building. At the same time, according to Dr. John S. Billings, he must feel no currents or drafts of air, and must be perfectly comfortable as regards temperature, being neither too hot nor too cold.

The air required to meet these conditions must not be less than 2,000 cu. ft. per hour for each person, with the same amount per hour for each cubic foot of gas consumed, whether for light, heat or power. In a loft 25 ft. wide and 100 ft. long, containing 80 workmen, and lighted with electricity, the amount of air required would therefore be 160,000 cu. ft. per hour. This amount of air per hour would move at the rate of about one-eighth of a mile per hour, and would be sufficient to charge the supply once every 10 minutes, assuming a 10-ft. ceiling. The New York and Massachusetts state laws for school rooms require that change eight times an hour, and some authorities even recommend 50 per cent in excess of this.

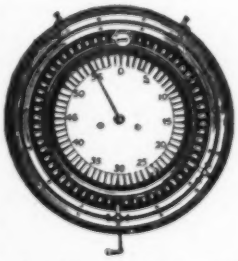
Dr. Daniel R. Lucas, of New York, states that it is a well known law of hygiene that one gas jet will consume as much oxygen as five persons, and,

if a building is so lighted, this must be taken under serious consideration. Since electricity does not consume the oxygen and has been reduced 50 per cent or more in cost by the new high efficiency lamps, it would appear that the easiest way to comply with the labor law regarding ventilation would be to abandon gas lighting.

The operating cost for a ventilation system is made up of two items, the first being power for turning fans, and the second, additional heat for incoming air. In the future it is probable that factories and lofty buildings will be equipped with ventilating apparatus at the outset, with the ducts concealed in the walls and the fans located in the basement. A model building of this character has recently been completed in New York City.

That proper ventilation is absolutely necessary is shown by this table, which was compiled by the bureau of labor at Washington to give an idea of the conditions under which factory workers who have died from consumption labored. The deaths are divided as follows: Exposed to metallic dust, 36.9 per cent; to mineral dust, 28.6 per cent; to vegetable fiber dust, 24.8 per cent; to animal and fiber dust, 32.1. The occupation showing the highest consumption mortality was grinders, among whom 49.2 per cent of all deaths were from the disease.

CLOCK FOR POLO FIELDS



An ingenious device has been installed at Hurlingham, one of the great polo fields of England, to time the plays in polo. It is a clock which sounds a bell at the end of each 10 minutes of play, and keeps count of the number of such periods until the end of the game.

The old, familiar accessory of the photographer, the head-rest, is fast disappearing.

SCENIC REPRESENTATIONS AS FLY TRAPS

Realizing that ordinary flypaper and fly traps on the dining-room table or in the windows of shops are far from

Artistic and Ingenious Fly Traps

artistic, a French inventor has designed a fly trap which makes a not unpleasant ornament for the table and a drawing attraction for store windows. He provides a disk formed with a ring of depressions or cups, which are baited with jelly or other foods that attract flies. By means of clockwork in the base of the trap the disk is slowly revolved, bringing the cups, one by one, under a vertical cylinder of wire netting. The trap is covered by miniature representations, the one illustrated being a windmill. The flies enter the door of the mill, and while they are busy eating the bait they are carried under the tower. Alarmed at this they fly upward, easily finding their way through the openings in the top of the cones. Once in the prison tower they cannot escape and must await the hand of the executioner.

SHIPPING ICE IN BARGES

The ice crop of the Hudson river was so scanty last winter, owing to the mild weather, that 350,000 tons were harvested on the Penobscot and Kennebec rivers of Maine to make up the deficiency. During the past summer this ice has been transported by barges to New York, Philadelphia and Baltimore. The barge companies get 40 cents per ton for its transportation.

ELECTRIC FANS IN A CATHEDRAL

In Bombay, India, the church authorities realize that artificial coolness is as essential in holding a large congregation as is artificial warmth in the churches of northern countries during winter months. More than 75 electric fans arranged about the columns of the St. Thomas Cathedral, as shown in the illustration, accomplish a result that is gratifying. The blades of the fans are coated with white enamel and lend attractiveness to the interior instead of detracting from it as might be expected. Looking down the center aisle, the blades give the idea of white doves hovering above the pews.

Courtesy London Electrical Review

The Fans Resemble Birds in Flight

GLASS THAT SEEMS MAGICAL

The ordinary person would smile at the possibility of windows through which he or she could watch the people in the street but through which the people in the street could only see themselves, yet this is now possible through platinized glass. By constructing a window of this glass, a person can stand close behind the panes in an unilluminated room and behold clearly everything going on outside, while passersby looking at the window would behold a fine mirror or set of mirrors in which their own figures would be reflected, while the person inside remained invisible.

In France various tricks have been devised with the aid of this glass. In one, a person, seeing what appears to be an ordinary mirror, approaches it to gaze upon himself. A sudden change in the mechanism sends light through the glass from the back, and the startled spectator finds himself confronted by some grotesque figure.

Such windows are made by coating a piece of glass with an exceedingly thin layer of a liquid charged with platinum and then raised to a red heat. The platinum becomes united to the glass, but the latter does not really lose its transparency. If placed against a wall, or without a light behind it, as above stated, it acts as an ordinary looking-glass, but when the

light is allowed to come through the glass from the other side, as when placed in a window, it is perfectly transparent like ordinary glass.

WARNING SIGN IN SIX LANGUAGES

A large industry that employs men of all nationalities places an enameled iron display sign around its high tension wires, on which a warning to the men is inscribed in five other languages than English. A reproduction of the warning in Polish, Croatian, Swedish, Italian and Hungarian is here shown.

NIEBEZPIECZNE
Nie Dotykarj-Idzprecz
NIEDRAJ
Opasno-Nepriblizujse
FARLIGT
Ror Icke-Akta Dig
PERICOLOSO
Toccare-State Lontano
VESZELYES
Hozza-Nyulni

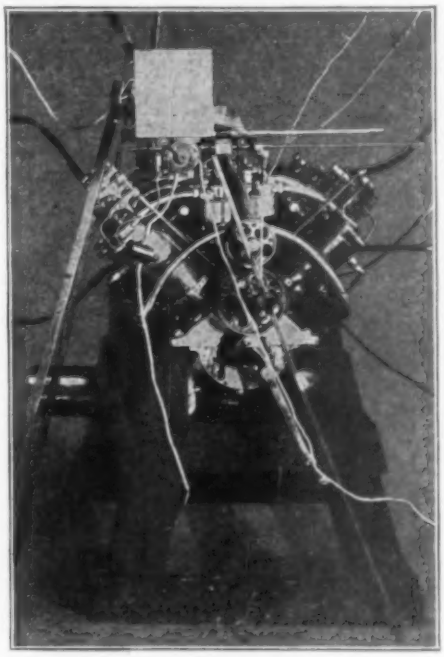
It somewhat resembles the diagram of a word puzzle. As a safeguard for protecting the lives of workmen, often ignorant of English, it is simple, cheap and effective.

SALTON SEA EVAPORATING

The United States Geological survey announces that the great Salton sea will completely disappear through evaporation by 1925, less than 16 years hence. This artificial sea, formed a few years ago by overflow from the Colorado river, is about 40 miles in length and in places 15 miles wide. It is a depression in the Imperial valley, the basin being 275 ft. below sea level, and the water in places is nearly 100 ft. deep.

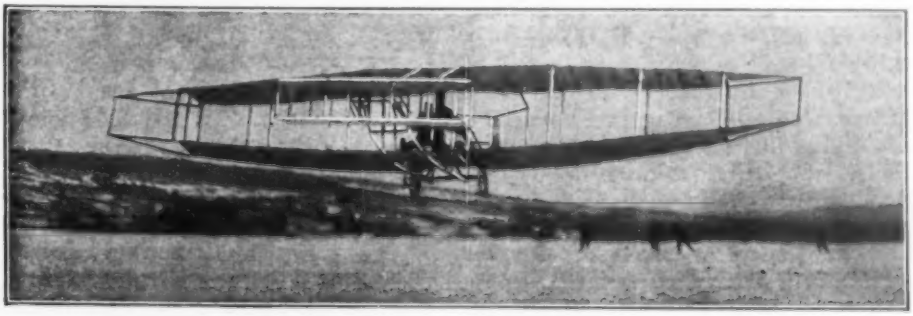
AERIAL EXPERIMENT ASSOCIATION'S BEST MACHINE

The Aerial Experiment Association, composed of a number of the foremost



Aeroplane Engine in Testing Block

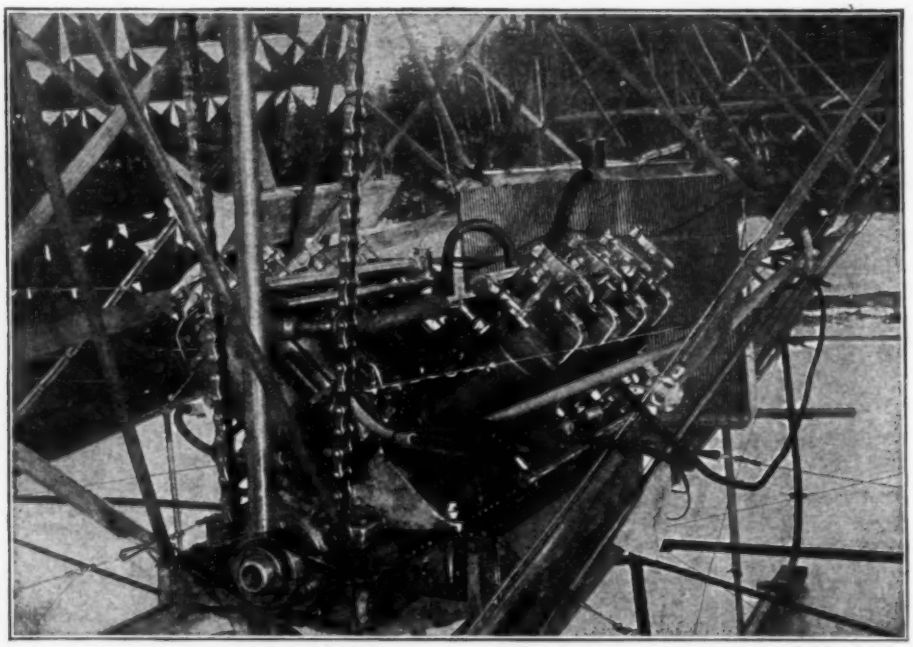
aeronautical experts in the United States, has disbanded after accomplishing the results for which it was formed. Experiments at Hammandsport, N. Y., and Bras D'Or Lakes, Canada, have developed a number of excellent flying-machines, the most efficient being the "Silver Dart," shown in one of these illustrations. This machine, with the exception of the Wright aeroplane, is the best developed in America, having



The Silver Dart Over Bras D'Or Lake

flown 25 miles over Bras D'Or Lakes.

The "Silver Dart" is equipped with the engine shown in the testing block. It is a 50-hp. Curtiss engine, weighing 175 lb., developing its 50 hp. at 1,500 revolutions per minute. The testing block in which it is shown is equipped with water-cooled brake, manograph, and a tachometer. The tachometer is one of three in America.



The Engine of Dr. Bell's Aerodrome

The third illustration shows a 50-hp., 8-cylinder, water-cooled engine, installed in Dr. Bell's tetrahedral aerodrome.

SHIP SIGNALING AT NIGHT

Several writers in marine magazines deplore the lack of knowledge in night signaling by the officers on the merchant marine still flying the American flag. Many instances are recorded of vessels of other nations signaling American merchant ships for aid at night and receiving no response, because the officers of the latter did not understand. Nearly all Atlantic liners and a great majority of tramp steamers are supplied with a flashing lamp or some suitable makeshift. An ordinary large-sized bullseye lantern or a 32-cp. electric globe can be made to do good service if properly handled.

The signals are all made by the Morse telegraph code. The tables of dots and dashes which form the letters and numerals are here given. The dots are flashes of about ½ second, and the dashes are flashes of about 2 seconds. A, is designated by one short flash or dot and one long flash or dash; B, by — . . . ; C, — . — . ; D, — . . ; E, . ; F, . . — . ; G, — — . ; H, ... ; I, . . ; J, . — — — ; K, — . — ; L, . — . . ; M, — — ; N, — . ; O, — — — ; P, . — — . ; Q, — — . — ; R, . — . ; S, . . . ; T, — ; U, . . — ; V, . . . — ; W, . — — ; X, — . . — ; Y, — . — — ; Z, — — . . ; Figures: 1, . — — — — ; 2, . . — — —; 3, . . . — — ; 4, ... — ; 5, ... ; 6, — . . . . ; 7, — — . . . ; 8, — — — . . ; 9, — — — — . ; 0, — — — — — (.)

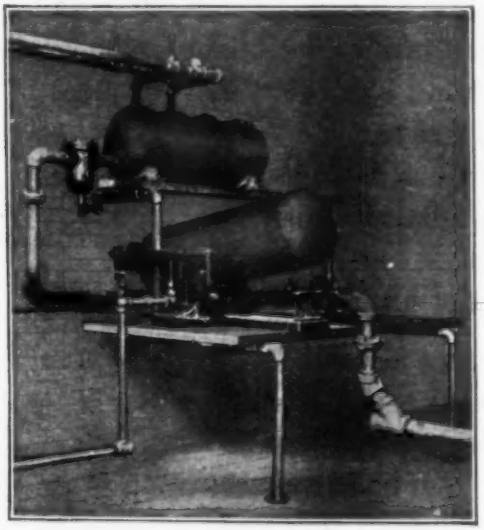
The commas after the letters and figures and the semi-colons after the dots and dashes are simply a matter of punctuation.

TILTING TRAPS FOR STEAM CONDENSATION

The illustration shows a tilting trap installation in Philadelphia used in connection with a large brewing kettle which requires live steam in its operation, with condensation of over 3,000 lb. of water per hour to be handled. Before using the tilting trap this condensation was pumped into the boilers at a temperature of 130 degrees from an open tank into which it was discharged from the kettle.

Above the direct return tilting trap was placed a receiver, connected to the return line of the kettle, as shown in the illustration. From the receiver the condensation water passes to the trap and is automatically discharged by gravity from the latter into the boilers through a pipe connected in both blow-offs.

Experiments with this installation proved that the condensation was being discharged into the boiler at a temperature of 250 degrees and at the rate of 3,028 lb. per hour, resulting in a saving of several hundred dollars per year with but slight additional expense for equipment.



Tilting Trap Installation in Philadelphia

At least 40 American colleges are now giving independent instruction in municipal government.

GIVING ORPHANS AN AUTOMOBILE RIDE

Orphans' day was celebrated in many of the cities of the country in the early part of June by taking the young charges out for organized automobile rides. Especially was this so in Denver and Detroit, in both of which cities the automobile clubs turned out in force to make the event a memorable one. There were 187 cars in the parade in Denver and nearly 800 children enjoyed a 30-mile ride. One automobile pulled a trailer which accommodated 21 children. Another automobile was rigged up as a supply wagon and filled with popcorn and candy.

Orphans Enjoying an Automobile Ride

THE FURNITURE MAKER*

His name is written on no roll of war
With stroke of steel and mighty crash of arms,
His sturdy step awakens no alarms
And at his shout no face is clouded o'er
With sudden terror or descending tears.
He has his triumphs and his victories;
But Peace and Progress, Praise and Plenty—these
The victories he gathers from the years.

His name is written on the blazing hearth,
Around the household's cherished ingleside,
Within the first dear cottage of the bride
And on the proudest mansion of the earth.
His creed is Comfort and his god is Love.
About our sweet domestic altars lurk
The gentle spirits of his handiwork—
These are the scenes he writes his name above.

These are the scenes that make the monument
Of this, the gentle craftsman of the Home.
And feet that wander far, and hearts that roam,
Shall often come returning penitent
To worship at old altars he has made—
A mother's rocker or a father's chair—
Finding no edifice afar as fair
As this the simple product of his trade.

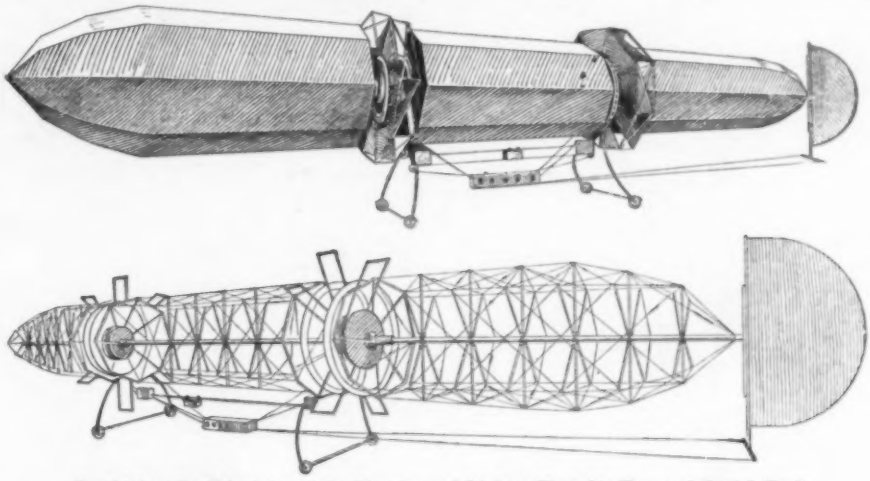
Builder of altars in the home and heart,
A labor near divinity is yours,
Yours is the craftsmanship that most endures,
For homes are builded by your honest art.
Think not the service humble from your hand,
But proudly, gratefully, your toil esteem—
For men no greater service do or dream
Than building firesides in a happy land.

—*Douglas Malloch.*

(*By courtesy of the Furniture Journal.)

HEAVIER-THAN-AIR DIRIGIBLE TYPE AIRSHIP

The airship known as the dirigible type is lighter than air, gas, as in a balloon, lifting it into the air, and propellers driving it forward. The airship here shown is of this type, but heavier than the air, the lifting power of its gas being only sufficient to raise nine-tenths of its weight. Its ability to fly, therefore, depends upon the power of its propellers, thus combining the principles of both the heavier and lighter-than-air types.



Combining the Principles of the Heavier and Lighter-Than-Air Types of Aerial Craft

The arrangement of the whole, which is the idea of a German inventor, is rather curious. The gas envelope is in three sections, rigidly stretched around an aluminum frame. Between these three sections are the two propellers, revolving on the stationary shaft which forms the center of the aluminum framework. The ascending and descending movement of the airship is obtained by means of a sliding weight which runs the length of a rail suspended under the body. The motors, one for each propeller, are to be suspended just under the propellers each operates in a car. As the shaft upon which the propellers are set is stationary, they work independently of each other so that damage to one of them will not put the other out of commission.

The idea of placing the propellers between sections of the envelope is not altogether new, a French inventor having already experimented with such an arrangement. But the envelope of the French machine was not rigid, was divided into only two sections, and had only one propeller.

SUN'S RAYS SET FIRE

There was an odd fire in the show window of Lloyd's optical goods shop, in Boston, one Sunday afternoon recently. The burning rays of the sun, striking some large magnifying glasses in the window, became focused upon some paper trimmings and set them afire.

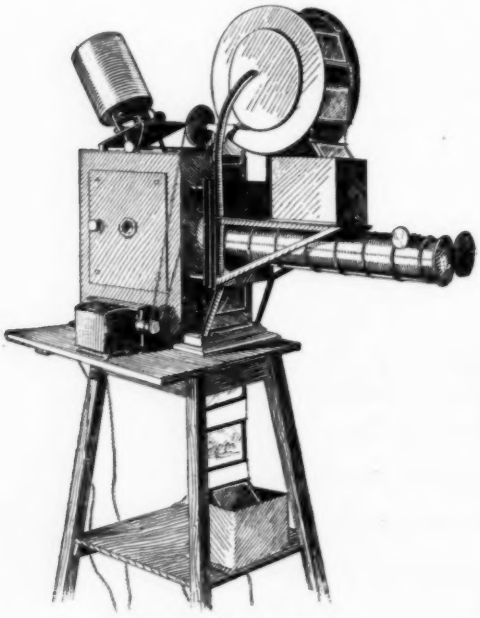
The police discovered the blaze and were in doubt what to do, as they could not find the janitor and did not want to break in the door or a large show window on account of a trifling blaze.

While they hesitated, a quick-witted genius rushed up and pasted some sheets of a Sunday newspaper on the window, thus obscuring the sun's rays, and the fire soon died out, with no damage.

That genius reminds me of the famous painter who, when asked what he mixed his paints with, replied: "With brains!"—Contributed by James P. Gorman.

AUTOMATIC FEEDER FOR MAGIC LANTERNS

The comparatively long pauses between the pictures thrown on a screen with the ordinary magic lantern, and



Slide Feeder for Lantern

the fact that each new slide exhibited has to be inserted in the lantern by an assistant, has led to the designing of this automatic slide feeder. The slides are linked together, in the order they should be shown, by chains and wound on a drum. The lecturer holds an electric button, connected with the feeder by a flexible wire, in one hand. As the lecture progresses he changes the screens by pressing the button.

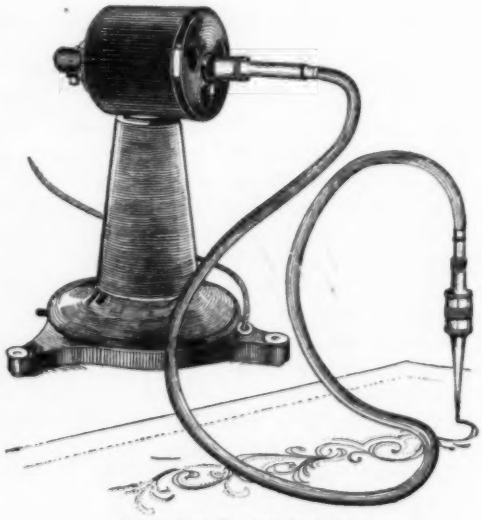
ARMLESS ARTIST EXHIBITS AT ROYAL ACADEMY

A picture, painted by an armless artist who accomplished his work by holding his brush in his teeth, drew considerable attention at this year's Royal Academy exhibition in London. The work ranks with the best efforts of many artists who have hands to work with, otherwise it would not have been accepted by the committee. The fact that the artist was armless, and the work excellent for one painting with the teeth, would not have caused its acceptance, had it not contained real merit. The armless artist is Bartram Hiles, but he is not the only one who has accomplished successful work. Sarah Biffin, who was miniature painter to Queen Victoria, was born limbless, and among the most prized portraits of Queen Alexandria is one of herself executed by Aimee Rapin, a French woman who had the misfortune to lose both her arms.

ELECTRIC PERFORATOR CUTS PAPER DESIGNS

An electric perforator or needle cutting device has been designed for cutting out wallpaper friezes, crowns and stencils, and perforating pounce patterns. The needle fits into a tool which is attached to the motor by means of a flexible shaft. The motor can be attached to any electric light socket.

By use of the apparatus the figures in ordinary commercial wallpaper can be made to appear like hand-painted decorations. The needle point has a speed of 5,000 oscillations per minute. It runs without vibration and it is as easy to follow a pattern with it as if tracing with a pencil.



Cuts Out Figures in Paper

HOW TO MAKE AN OAK-BOUND CEDAR CHEST

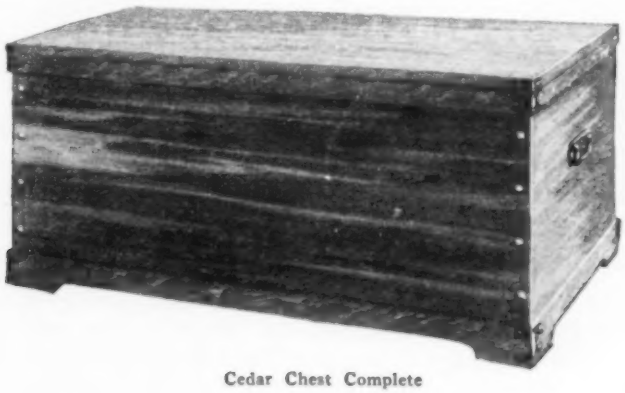
This cedar chest for storing unused bedding or furs is not a difficult thing to make and when made, the hard oak binding takes the wear and protects the softer cedar so that the chest ought to serve several generations. Order the stock as follows:

Cedar

2 top and bottom pieces, ⅞ by 16½ by 34½ in., S-2-S.
2 sides, ⅞ by 18⅞ by 34½ in., S-2-S.
2 ends, ⅞ by 18⅞ by 14¼ in., S-2-S.

Oak

2 overhanging top pieces, 1 by 1 by 36½ in., S-4-S.
2 overhanging top pieces, 1 by 1 by 18½ in., S-4-S.
2 lock and hinge rails, 1 by 2½ by 36½ in., S-2-S.
2 lock and hinge rails, 1 by 2½ by 18½ in., S-2-S.
2 base pieces, 1 by 3¼ by 36½ in., S-2-S.
2 base pieces, 1 by 3¼ by 18½ in., S-2-S.



Cedar Chest Complete

Specify thoroughly seasoned Tennessee red cedar and plain sawed white oak and have the different pieces mill-planed and sandpapered as indicated in the stock-bill. This bill allows ½ in. extra on the length and the width of each piece for "squaring up" of all pieces except those marked to be surfaced on four sides.

Begin by squaring the sides and ends to size. Probably the best joint for the corners is the dovetail. If the worker is not experienced in woodworking, some of the more simple joints will do. It will be noted that the drawing and stock bill call for the simplest form of joint, that in which the sides of the chest lap over the end. For the dovetail joint it will be necessary to add 2 in. more to the length of the end pieces, making them 16¾ in. each in the rough.

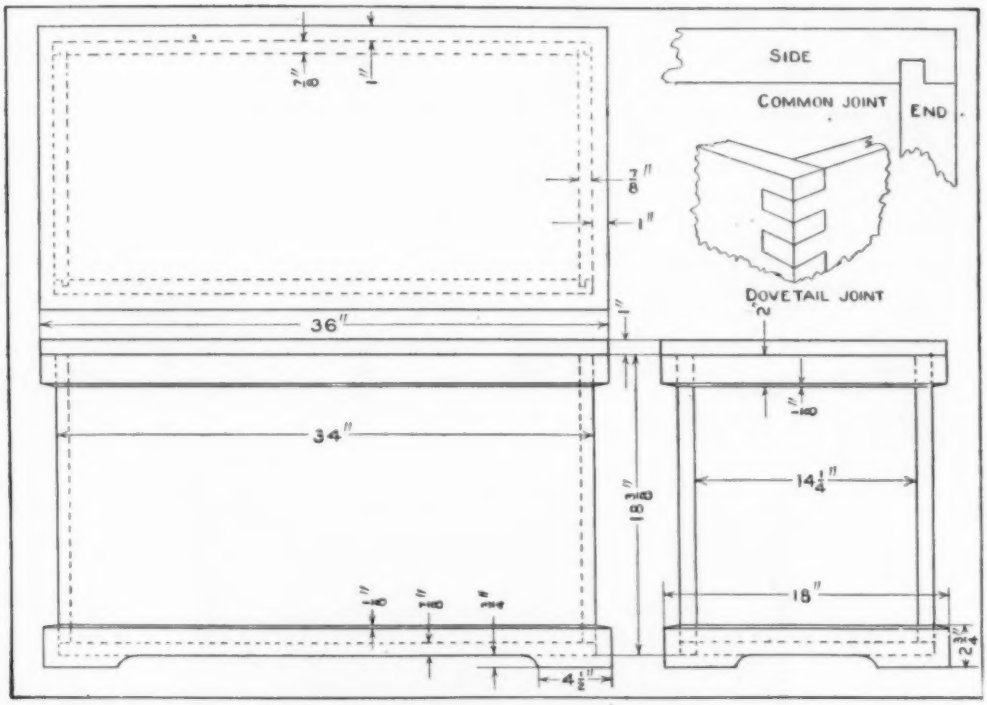
Having got the sides and ends ready, fasten them together. The perspective shows the sides fastened to the ends with ornamental headed nails. Common nails are first used, being equally spaced, and the ornamental heads are afterwards placed so as to cover their heads.

Next square the bottom and nail it to the parts just assembled. Square the top to the same size.

The base stuff is squared on one edge only. The second edge—the upper one—is to be beveled or sloped ⅛ in. to facilitate dusting and for appearance sake. Fit these base pieces to place, mitering the joints. Before fastening the parts to the chest proper, gauge a line ¾ in. from the lower edge and to a point 4½ in. from each end, cut out to this line and shape the base as shown in the drawing. Use finishing nails for fastening the base to the chest. The heads should be "set" so they may be covered later with a putty colored to match the finish.

In a similar manner plane up, cut and fit the back and hinge rails. These rails should be kept a "scant" ⅛ in. below the top edges of the chest proper. The overhang of the lid fits down over in such a way as to form a dust-proof joint between lid and chest proper.

The overhang of the lid of 1 in. by 1-in. stock may next be mitered, fitted and nailed to the lid. Thoroughly sandpaper all parts not so treated and



Details of Cedar Chest Construction

finish as follows: Put on all the oak pieces, two coats of natural paste filler. This is best done before they are fastened in place. Directions will be found on the cans in which the filler is kept.

The red of the cedar may be heightened by applying a mahogany stain made of Bismark brown aniline and boiling water, in the proportion of 3 qt. of water to 1 oz. of aniline. If applied hot the stain will enter the wood better. When dry, sandpaper lightly with No. 00 paper, both this and the oak-filled pieces.

Fasten the oak pieces in place and give the whole exterior a very thin coat of shellac. After this has hardened, apply two coats of wax. Wax comes in paste form and is to be applied with a cloth very sparingly. Allow it to stand five or ten minutes then rub briskly with a soft dry cloth to polish. The first coat is allowed to stand 24 hours before the second is applied in a similar manner.

Another finish, known as an egg-shell gloss shellac finish, is obtained by omitting the wax and instead applying from two to five more coats of shellac. Allow each coat 24 hours in which to harden, and rub each hardened coat to a smooth finish, using curled hair, or fine steel wool, or fine oiled sandpaper, before applying the next.

The metal reinforcements for the corners can be bought at a hardware store, as can the lock, hinges, and handles. These parts are applied in the usual manner—butt hinges being used.

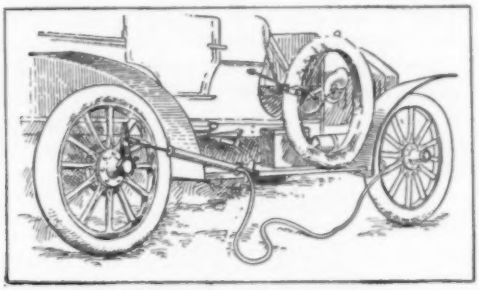
If well made, the chest is practically airtight. The interior is all of red cedar, while the effect of the exterior in combining the light oak and the red cedar is striking.

When an acetylene lamp is in good order it will light up slowly with a hissing noise followed by a pure white flame. Should the lamp light up quickly with a yellowish flame, it is a sign of a leak somewhere.

SHOP NOTES

An Automobile Inflating Its Own Tires

The inflating of large automobile tires may be easily accomplished with

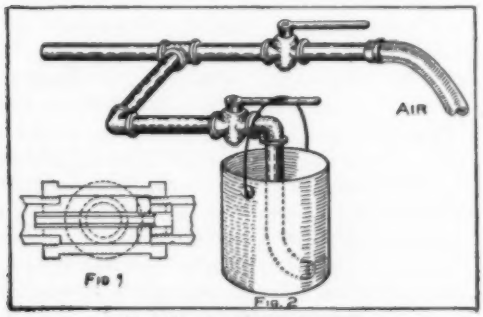


Driven by Its Own Power

the device shown in the illustration, which consists of an old foot pump, a short steel rod, a wrench and 10 ft. of hose. A crank is made from the wrench which is attached to the end of the pump plunger. The bottom of the pump can be attached to either foot board with the steel pin. The pump can be quickly attached to either side of the automobile so that it will inflate all tires by placing a jack under the rear wheel that is connected to operate the pump; start the engine and watch the gauge.—Contributed by Herman Guentzler, Cleveland, O.

Home-Made Paint Sprayer

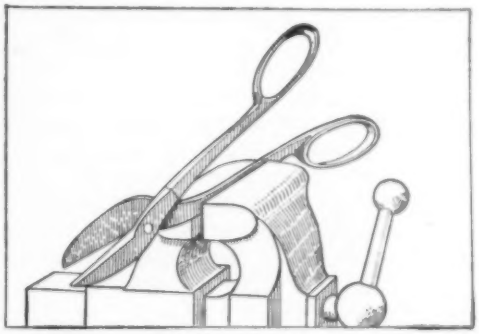
There are many places on a locomotive that are not easily reached with a painter's brush, which necessitates some kind of a spraying device. The sketch illustrates a sprayer gotten up by the workmen of a railroad division shop for rapidly painting locomotives. Pipe and pipe fittings are used in the making of the sprayer and the only part that requires any special construction is the tee connection. This tee is fitted with a nozzle, as shown in Fig. 1, similar to an ejector. The air passing through the small pipe forms a vacuum which draws the paint from the pail and forces it through the extending pipe in a spray. The sprayer is connected to the paint pail and air pipe as shown in Fig. 2.—Contributed by James E. Histed, Shawnee, Okla.



Details of a Paint Sprayer

How to Cut Heavy Metal with Tinner's Snips

Sheet metal that is too heavy to be cut with a thumb and finger hold on



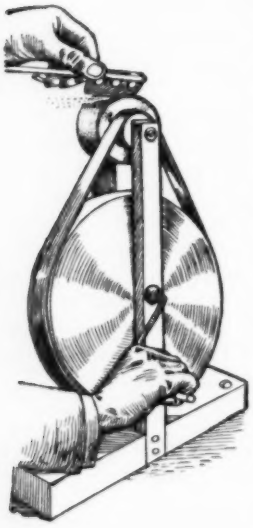
Holding the Snips

the snips may be easily accomplished by placing the snips in a vise as shown in the accompanying sketch. Also, more accurate cutting can be done by this method.—Contributed by Geo. W. Richardson, Chicago, Ill.

Ball bearings should not be overlooked altogether just because they require so little oil.

Home-Made Safety Razor Sharpener

An easily made and effective apparatus for sharpening the blades of safety razors is shown in the accompanying sketch. The sharpener has a cylinder covered with leather and dusted with emery flour. The driving wheel is about 6 in. in diameter, and the pulley to which the sharpening cylinder is attached, is ¾ in. in diameter. The cylinder is 2 in. in diameter and 1½ in. long. These sizes may, of course, be varied, as the object of the belt is to give a rapid motion to the sharpening surface.



The driving wheel is made of two disks of tin mounted on a piece of heavy wire as an axle and soldered with their planes vertical to the axle about ½ in. apart. One end of the wire is bent into a handle for turning the wheel. A strip of tin, ½ in. wide, is soldered between the edges of the rims around the circumference to carry the driving belt. This wheel may be made of the ends of fruit cans, or of wood. The pulley is turned like a spool, or may be an empty thread spool. The cylinder is made by soldering two of the flaring disks from the soldered-up ends of a corn can on the pulley axle, putting them with the concave faces outward about 1½ in. apart, and winding on the axle between them strips of muslin smeared with glue or paste until the space is filled nearly to the circumferences of the disks.

The driving wheel, pulley and cylinder are placed in position for running between light upright posts fixed in a piece of board as a base. The driving belt may be made of a piece of leather or a broad shoestring. The filling of the sharpening cylinder is completed by the addition of the paste made of plaster of paris and glue. The cylindrical surface is made to run true to the axle by fixing a strip of metal as a gauge near the surface, and adding the paste until every part of the surface when the cylinder is rotated touches the edge of the gauge. Then a piece of thin leather is pasted neatly around the cylinder, and the surface roughened with sandpaper. The emery flour, which should be the finest grade, may be applied by dipping a small roll of muslin 2 in. or more long into the flour and brushing the leather with the floured end.

The blade is held for sharpening in one end of a wooden rod which may be made as follows: A piece of hickory, or other tough wood, about 5 in. long is so shaped that about 1½ in. at one end is double the width of the remainder of the piece which may be about the thickness of a common lead pencil. A saw-cut is made longitudinally in the projecting part of the broad end, the cut being directed toward, and parallel to, the axis of the longer end; and the cut is reduced in thickness by gluing strips of muslin or strong paper in it. The blade should push tightly into the cut. The smaller end of the rod serves as the handle, and when the blade is in the cut, it is sharpened by holding first one face of the cutting edge at the proper angle against the rotating surface, and then the other. The sharpener stand may be clamped or screwed to a table or window sill.

The effectiveness of this apparatus is largely due to the rapid movement of the sharpening surface against the blade. This light rapid rubbing is a much quicker and much more effective method of sharpening a blade than the slow and uncertain method of honing and stropping. I have kept a blade of a dime safety razor, as a test of the sharpening apparatus, in good cutting order, shaving with it three times a week, for six months with this rotary sharpener, while by honing and stropping I was unable to get it to cut at

all.—Contributed by Thos. R. Baker, Winter Park, Fla.

Solution for San Jose Scale

The best preparation, easiest to make and perhaps fully as effective as any for destroying San Jose scale, is the lime, sulphur and salt solution, which is prepared as follows: Lime, unslaked, 20 lb.; sulphur (flowers), 18 to 20 lb.; salt, 8 lb.; water, 60 gal. Slake the lime in 5 or 6 gal. of hot water, using an iron kettle with a capacity of 25 or 30 gal. While the lime is slaking sift in the sulphur gradually, at the same time keeping the mixture stirred and adding enough water to make a thick paste, says Florists' Review. Then add the salt and about 10 gal. water and boil for nearly an hour. Pour through a strainer made of tin or brass wire, 16 meshes to the inch. Add water to make 60 gal., and the mixture is ready for use. Larger or smaller quantities can be made in the same proportions.

The nature of the insect makes it evident that if it is to be destroyed the agency of destruction must be so thorough in its work that not one can escape; otherwise further trouble will be in store for the future.

Drawing Table for a Shop Manager

The shop manager, superintendent, or general foreman, or perhaps the proprietor of the shop, has ideas of his own which he desires to put on paper before turning them over to a draftsman to be worked out in detail, says American Machinist. Few offices have any good place for a regular drawing table and the drawing board which lies on the desk and has to be laid aside at all too frequent intervals is far from being satisfactory in any way. The sketch shows how this problem has been solved by the owner of a shop. The arrangement consists practically of a shallow cupboard built against the partition of the office and having its front in the form of a very substantial drawing board.

As a Drawing Table

As a Desk

When open for business the short leg on the outside of the board rests on the top of the table underneath, being prevented from marring this by the use of felt on the end of each leg. In this position it represents a good sized drawing board at the right angle, and, as will be seen, is equipped with a universal drawing machine which always remains in place the same as on any drawing board. The shelves afford convenient places for drawing tools and reference books, while scales, triangles,

or anything else which may be used, go at the right.

When from interruption or otherwise it becomes necessary to leave the drawing board, it takes but a moment to close the front, which fastens with a snap lock, and everything is out of the way. At the same time it is thoroughly protected from dirt and inquisitive inspection, as can be seen in Fig. 2, and leaves the table beneath clear for looking over any blueprint or other plan which may be necessary. A drawing-board set of this kind can be used to advantage in many places, especially as the cost is not excessive in any way.

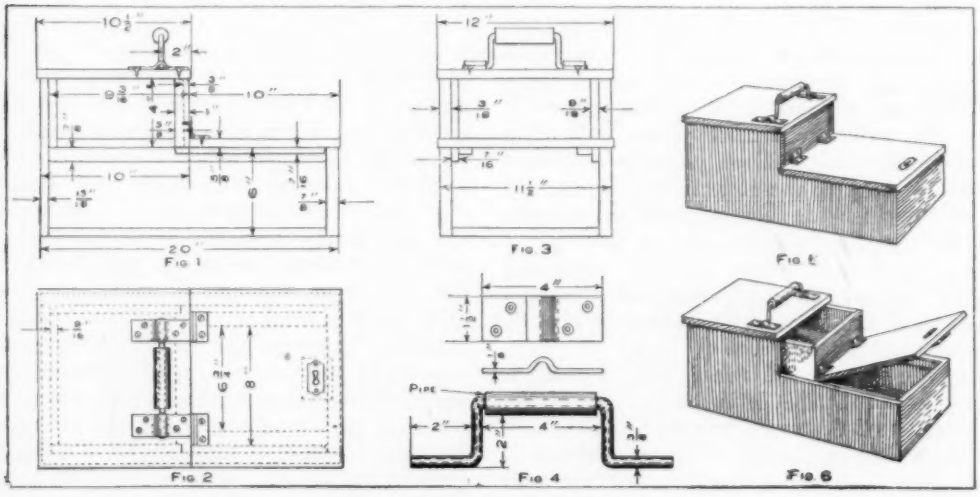
A Shop Tool Box for Floor Mechanics

The mechanic working on a floor where locomotives, traveling cranes and large machine tools are constructed, finds it necessary to have a small tool box that can be carried from place to place wherever some work is to be done. The box illustrated is one that can be carried about and, when necessary, it can be locked and left without the danger of the tools being stolen.

The top is fitted with a drawer attached to the cover with hinges and by lifting this cover the drawer may be pulled out. When closed, and the cover locked, the drawer cannot be withdrawn. Figures 1, 2 and 3 give the dimensions for the sides, top and ends, and Fig. 4, details of the handle; Fig. 5 shows the box closed and locked; in Fig. 6 the box is shown open.—Contributed by Urban A. Towle, St. Albans, Vt.

Wax Finishing

In wax finishing hardwoods, use a paste filler and shellac varnish to get a good surface. Of course, the wax may also be rubbed into the unfilled wood, but that gives you quite a different effect from the regular wax polish, says a correspondent of Wood Craft. With soft woods you first apply a stain, then apply a liquid filler or shellac, according to the quality of work to be done. The former for the cheaper job. The usual proportion of wax and turpentine is two parts of the former to one part of the latter, melting the wax first, then adding the spirits of turpentine. For reviving or polishing furniture, you can add three or four times as much turpentine as wax, all these proportions to be by weight. To produce the desired egg-shell gloss, rub vigorously with a brush of stiff bristles or woolen rag.

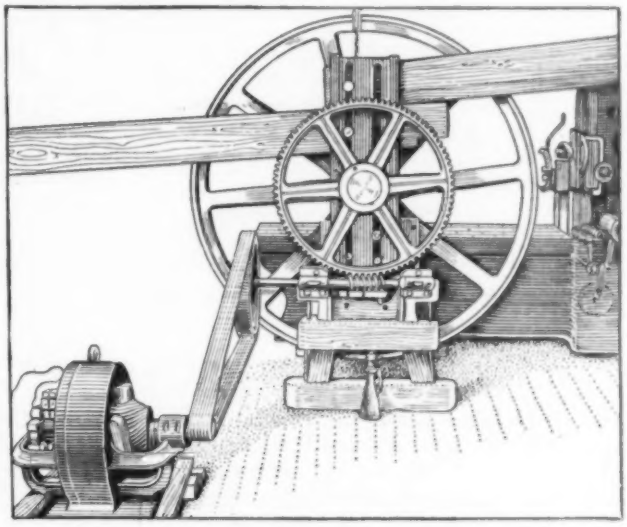


Details of a Mechanic's Tool Box

Turning a Large Flywheel on a Planer

Amongst the debris of a fire an 8-ft. by 16-in. face flywheel was found to be warped so that it was necessary to true the face before the wheel could be used again. Owing to circumstances it was not desirable to take the wheel off the shaft, says Southern Machinery. There was no lathe or boring mill convenient that was large enough for the wheel.

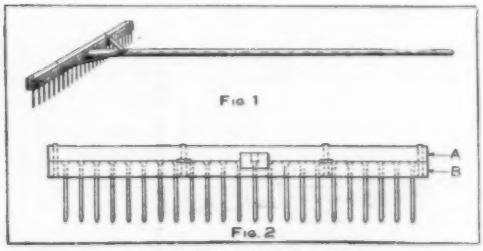
The accompanying illustration shows the method that was employed and the rig. The shaft holding the flywheel was placed in boxes and blocked up so that the wheel cleared the floor. On one side the blocking rested on the floor, and on the other on the planer platen. A portable boring bar with a large gear and worm were attached to the end of the shaft and belted to a motor. The cutting tool was forged, as shown in the illustration, and set in the planer head, which was moved across the face of the flywheel as the cut progressed. The illustration shows the arrangement to good advantage, and no further explanation is required. The time occupied in rigging up and doing the work was 60 hours.



A Makeshift Turning Job

Home-Made Garden Rake

Recently I was in need of a garden rake and as our local hardware merchant was out of them at the time, I set about to make one for immediate use. At the mill I secured two pieces of white ash 1 in. thick, 1½ in. wide and 2 ft. long; one piece 2 in. square at one end and 1 in. square at the other, and 6 ft. long, all three pieces were surfaced on all sides. On one of the 2-ft. pieces, B, Fig. 2, I marked the places for the teeth, making them 1 in. apart, and bored a hole in each mark with a bit that would make a hole almost the size of a 16-penny nail and countersunk the holes on one side for the heads of nails. Into these holes I placed 16-penny nails with their ends sticking through for the teeth. The other 2-ft. piece I used for a cap to hold the nails in place. The cap was riveted to the piece holding the nails with four rivets, one at each end and one between the fourth and fifth nail on each side of the center one. These last two rivets also serve the purpose of holding the ends of two braces made from hoop iron. A mortise was cut in the two pieces for the handle, one-half in A and the other in B, before placing the nails in the holes. The middle nail passes through the handle and the piece B.



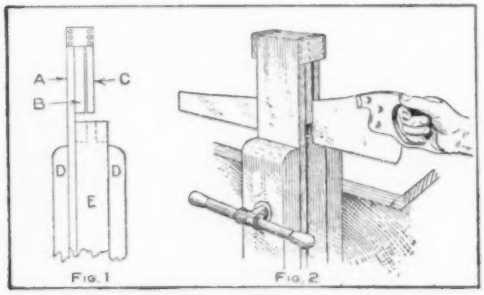
Nails Are Used for Teeth

As this rake was too large for some work, I made another which is double. Holes were bored 1 in. apart in one piece for the large nails, and ½ in.

apart in the other for small nails, thus making a coarse and fine rake.—Contributed by Thos. H. MacMillan, Moscow, Penn.

Cutting Tenons with a Hand-Saw

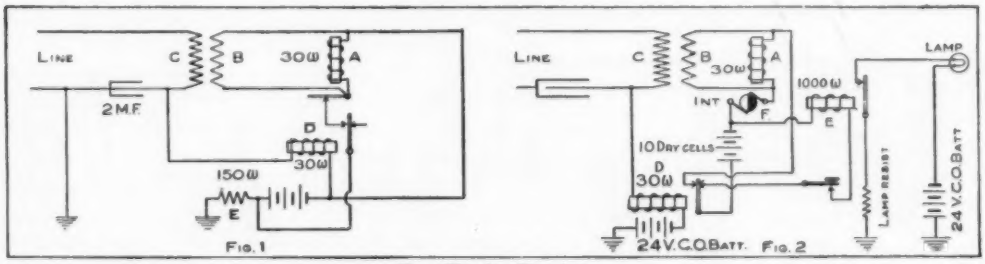
This home-made tool will be a great help in the construction of mission furniture. With its use, tenons may be entirely cut with a saw, discarding the use of a chisel and mallet. The device consists of a convenient length of straight board, A, Fig. 1, wide enough to cover the widest piece to be tenoned. A piece of board, B, is fastened to A with brads or small screws. This board should have a thickness equal to the piece to be cut from the side of the tenon. The piece C is fastened to A and B with small cleats at their upper ends. The space between B and C should be wide enough for the blade of a saw to run through easily, and also long enough to take in the widest part of the saw blade. The tool and piece to be tenoned are placed in a vise as shown in Fig. 2. The width of the piece removed for the tenon may be varied by putting in pieces of cardboard between the work, E, and the piece A, Fig. 1.—Contributed by W. B. Sanders, Pine Bluff, Ark.



Sawing Tenons

Howler Circuits for Telephone Lines

Here are shown two circuits for use on telephone lines to make a subscriber hang up the receiver when he thoughtlessly leaves it off the hook. Figure 1 shows a circuit which operates only when the receiver is not on the hook, being applicable to normally open circuit lines, says a writer in Telephony. The operation depends upon the "kick back" or counter E. M. F. of a magnet, A, when its battery circuit is broken, as by a buzzer, relay, or other apparatus. This current passes through the primary, B, of an induction coil, such as is used in ordinary local battery substation sets. The secondary current, set up in C, passes directly to the line, the 2M. F. condenser being inserted to permit the relay D to operate. Relay D operates through battery of five to ten dry cells, and the highest resistance, E, that will allow it to work connected to ground on one side, and through the coil, line and substation set, back to earth on the other side. A back contact on D can be used for supervision purposes. A modification of this circuit, as applied to a well-known type of common-battery exchange is shown in Fig. 2. Relay E was added to prevent howler current from kicking back through batteries, it not being practical to use retardation in the circuit. The resistances of parts shown are not necessarily to be adhered to, they being noted to show actual working conditions as now in service.

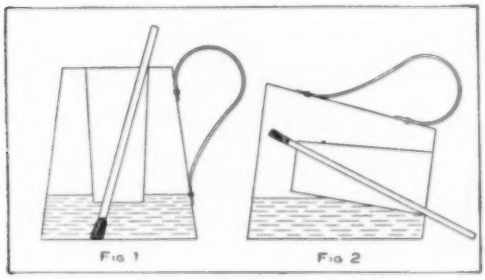


Two Howler Circuits

The circuit of Fig. 1 was mounted in a small box, and is used for a tone-test, no side-tone from induction or leakage being possible, as the set is inoperative until a metallic circuit is closed. By short circuiting the condenser, a very heavy current, with high voltage, is obtained, being good for breaking down faulty pairs, etc.

Non-Spilling Soldering Acid Receptacle

A handy acid receptacle, which will not spill the acid when it is tipped over, can be made from sheet lead or copper in the shape shown in the drawing. The dimensions for a very good size of cup are as follows: The cup is about 2 in. high with the diameter at the bottom 1⅞ in. and the top 1¼ in. The

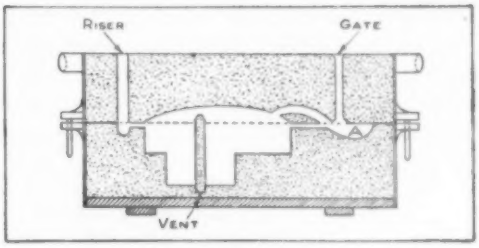


The Acid Will Not Spill

inner tube or opening for the brush is ¾ in. in diameter at the top and slightly tapering toward the lower end. All the joints are securely soldered. Should the cup be tipped over, the acid will run on the side, as shown in Fig. 2, without spilling.—Contributed by Frank Nicolin, St. Paul, Minn.

How to Make Clean Castings

Various devices have been used for the purpose of making clean castings, but none of them gives as good results as the simple kink illustrated in the sketch. This shows a section of an engine eccentric in a mould with the vent, riser and gate. A basin, A, is cut in the drag back of the gate on an incline from the casting. Any dirt that goes down with the melted metal will be forced into this cavity and kept



Moulding a Crank Disk

there by the force of the metal. A side riser is preferable to one on top of the casting, as the iron flows in the riser before the mould is full, carrying with the metal any sand or loose blacking that may have collected during the pouring of the mould. The gate must be filled as soon as possible, and kept full until the iron reaches the top of the riser.—Contributed by John S. Butcher, Vineland, N. J.

Proper Heat for Babbitt Metal

The greatest mistake in using babbitt metal is heating too hot before pouring. When the metal is hot enough to light a small pine stick, it is ready to pour. Never heat the metal until it shows red. Babbitt that has been overheated or burnt crystallizes, and when poured is brittle, hard and not homogeneous. Never mix overheated metal with the good hoping to restore it, as such mixed metal will be brittle.

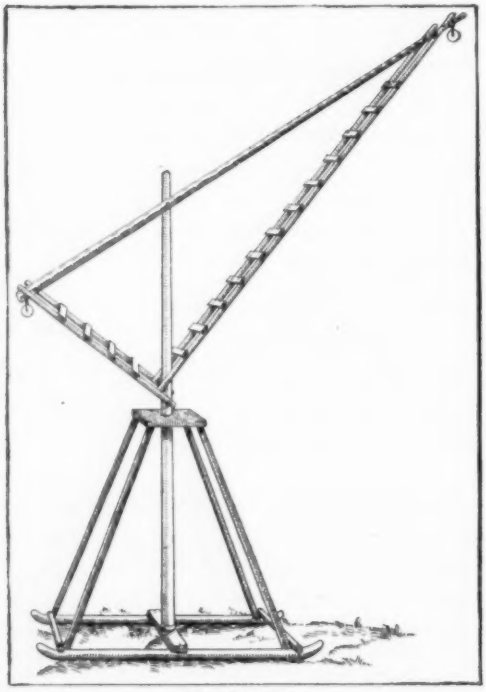
Home-Made Carpet Beater

Secure a piece of old garden hose about 3 ft. long, slip one end on a 2-ft. length of broom handle and tie it securely. Cut the loose end of the hose in narrow strips, allowing them to hang from the part tied to the broom handle. This makes an excellent beater for rugs and carpets.—Contributed by E. Lea, Brunswick, Mo.

Carpet Beater

Home-Made Derrick Hay-Stacker

The derrick consists of two principal parts, a revolving boom pole or crane, which swings in a complete circle, and



Hay Derrick

a framework for supporting the crane. The crane part is made with an upright mast 25 ft. long and 10 in. in diameter at the base. The base has an iron band shrunk on the wood and a 1¼-in. iron pivot pin, 12 in. long, driven into the end.

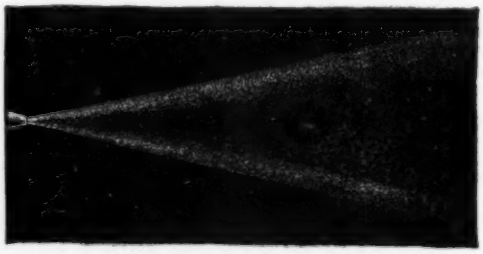
The mast supports a boom pole 33 ft. long and 5 in. in diameter at the small or upper end. This boom pole is fastened to the top end of the mast at a place 11 ft. from the butt end. The top is about 32 ft. from the ground when in position. The boom pole is supported by a pair of long poles for the top and a pair of shorter poles at the bottom for braces. The lower ends of these braces are bolted to the mast in its center as shown in the sketch. A pulley is attached to each end of the boom pole.

The base of the supporting framework is made of two poles about 8 in. in diameter and 18 ft. long, the under side of each end rounded up like a sled runner. The poles are placed about 15 or 16 ft. apart and joined together with a 4- by 6-in. piece at each end, and a heavy timber in the center. The upright mast is pivoted to the center of the heavy timber, forming the lower bearing. The upper bearing is about 11 ft. higher, made of a platform 4 ft. square, constructed of plank 2 or 3 in. thick. This platform is supported by 4 posts about 5 in. in diameter, the base of the posts bolted or toe-nailed to the sled-runner pieces near each end of the pieces and about 15 ft. apart. The tops of the posts support the upper platform of plank. The center of the platform is cut out to receive the revolving upright mast forming the upper bearing. It is better to protect the mast at this point by a thin steel plate about 6 by 12 in., says Hoard's Dairyman, also, it is better to have two plates at the bottom of the mast with holes for the pivot pin in the center of the plate.

To give the supporting framework additional strength and stiffness, it is best to attach two long braces from the bottom of each of the four sides to the opposite upper corners. A rope of pure manila, ¾ or ⅞ in. in size, is large enough. Three pulleys and 80 ft. of rope are sufficient when using hay forks, but if a sling is used, 115 ft. of rope and 4 pulleys will be necessary.

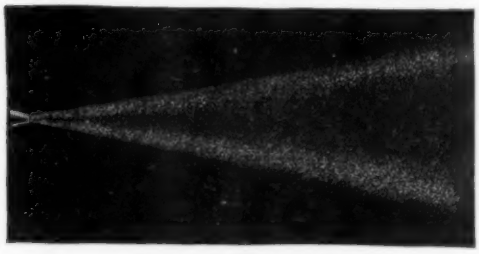
Proper Atomization of Fuel Oil

Frequent tests of boiler pits with open flames, and many months of successful operation have convinced the



Imperfect: Causing Smoky Fire

most skeptical that oil burners for steam boilers are practical, safe, and convenient attachment, even as auxiliary equipment. The old time explosions which occurred now and then were due to the fact that the oil dripped down and later evaporated until the mixture with air became explosive, says Practical Engineer. Oil must be thoroughly mixed with air in order to secure complete combustion with no smoke coming from the stack. If the spray of oil contains some small and some larger particles of oil, the larger particles being supplied no more air than the smaller ones, will not be burned, and the result will be a coating on the boiler tubes which is more difficult to remove than the soot deposited from a coal fire. This difficulty has been entirely overcome by the latest designs

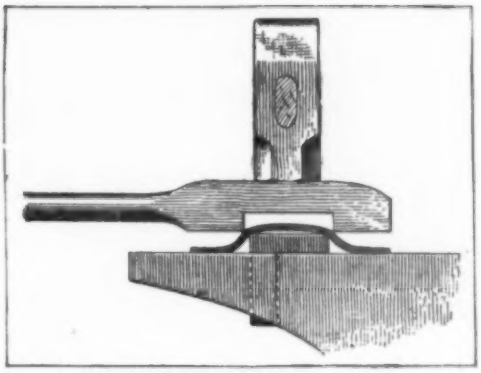


Perfect Atomization

of nozzles, which give a steady fire and no smoke.

How to Make Wagon Box Staples

A small lot of wagon box staples were ordered made and all of them had to be exactly the same size, says a correspondent of Blacksmith and Wheelwright. Anyone making hand-forged pieces knows how hard it is to get them all exactly alike. After giving the subject some deliberation the device shown in the sketch was constructed to give a uniform bend to each staple. The bottom tool was made to fit the square hole in the anvil having a face equal to the size of the hole wanted in the staple, ⅝ by 2½ in. in this instance. The top tool had a recess made equal to both bottom tool and the size of the staple when completed. The stock was heated, roughly bent, and placed in the

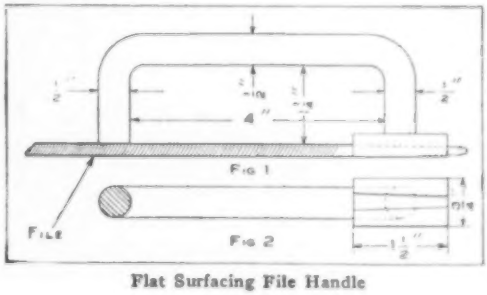


Dies for Forming the Staples

position shown in the cut. A few strokes with the hammer completes the staple in one heating. This device is easily made in a few minutes by using scrap material, and will pay for itself in making a dozen staples.

File Handle for Surface Filing

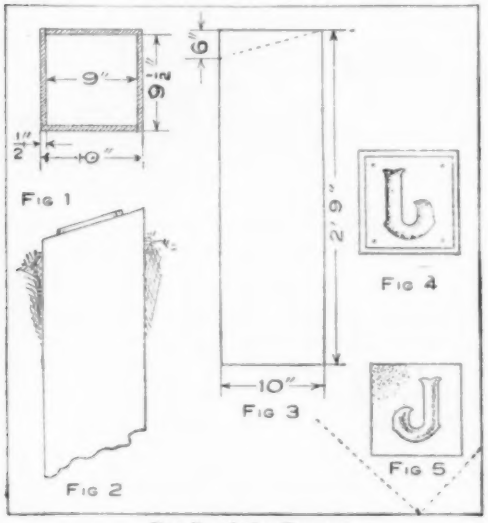
When filing a flat surface with a file the ordinary handle will be in the way, if the piece being filed has a large surface. A handle constructed as shown in the sketch will hold a file so it will have a clear surface on the under side. There is no danger of the file coming loose in the handle, as the shank will tighten when the file is being used. The handle proper is made from ½-in. round iron with a flat piece of metal welded to one end and the round iron bent in the shape shown in Fig. 1. The under side of the flat end has a slot cut tapering to fit the shank of the file. Any file shank will fit in the slot and become tight enough to hold the file when in use.—Contributed by Fred W. Whitehouse, Upper Troy, N. Y.



Flat Surfacing File Handle

Concrete Corner Post for a Cemetery Lot

A neat and serviceable corner stone for cemetery lots can be made from



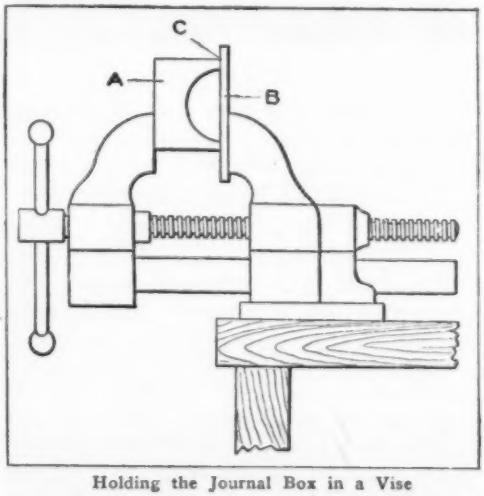
Details of the Forms

concrete tamped in a mould of suitable size that has the desired initial carved in one end. The instructions herein given and the sizes mentioned in the sketch will make a very well proportioned corner stone. The form is made from four ½-in. boards 9½ in. wide and about 3 ft. long. The four boards are nailed together as shown in Fig. 1. Saw off one end of the box thus made, as shown in Fig. 3. Make an end to cover the sloping part from the same material, 10 by 10¾ in.; also, carve or saw the desired initial in a piece of wood having a size that will fit neatly into the open end of the box. Fasten the initial piece to the one cut for the end so the letter will be the reverse as shown in Fig. 4 and nail both of them to the sloping end of the box. This completes the form for the concrete mixture.

The form is placed against a wall with the initial end down. Dust the inside of the box and fill with concrete to within 3 in. of the top, tamping after throwing in every two or three shovelfuls. Allow the form to stand in a moderately warm and damp place so that the concrete will not dry quickly. The concrete will set and dry in 3 or 4 days. When taken out of the form, the initial end is coated with a neat mixture of cement for about 8 in. on the sides and end. The posts are set in the ground at each corner of the lot so that the smooth portion extends 6 in. above the ground.—Contributed by Wright I. Jackson, Oak Park, Ill.

How to Square a Journal Box

A great deal of trouble will be experienced in filing bronze boxes to get them square, unless one is very much in practice with the use of a file. A good way to cut them square is to hold one-half of the box, A, against a square piece of steel, B, in the vise and saw between the box edge and the steel at C with a hacksaw, as the box is the softer, it will be cut, and the steel will keep the saw square. Do not saw all the way through on one side without starting on the other, or matters will be worse than when starting, says Practical Engineer. Leave just enough to hold, then when it is removed the job



Holding the Journal Box in a Vise

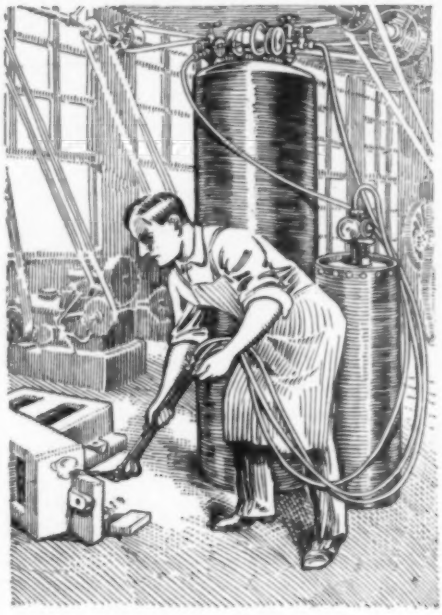
will be as good as if done on a planer, needing only a little touching with a file.

A solution of potash and water rubbed on birch will give it the appearance of rosewood when varnished.

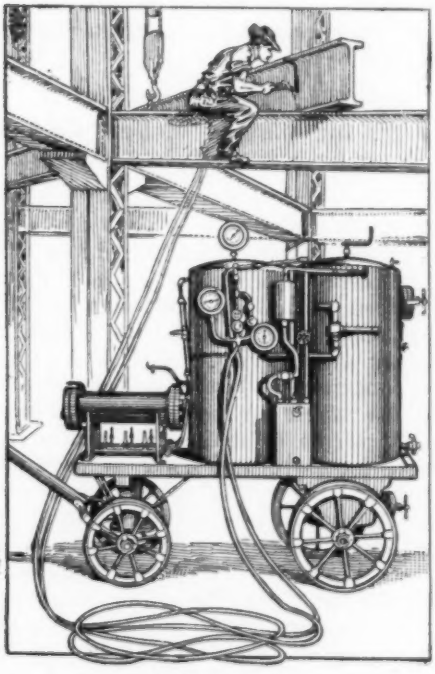
Oxy-Acetylene Welding and Cutting Outfit

There has developed in the past few years a valuable tool in the oxy-acetylene torch or blowpipe for welding, cutting and forming metals. The torches are made in three distinct types, low, medium and high pressure; their names derived from the pressure of the gases used. The temperature produced by the oxy-acetylene torch is nearly equal to that of the electric arc, being 6,300 deg. F. This makes it possible to reduce any small portion of metal to a molten state very quickly. One of the most difficult metals to fuse is platinum and its melting point is only 3,227 deg. F., so the possibilities of using a flame of such high temperature can be realized when it is remembered that the melting point of steel is about 2,700 deg. F.

The first outfits using oxy-acetylene were not self-contained and steel tanks or bottles filled with oxygen to a high pressure had to be purchased. The acetylene gas was also put up in tanks in a similar way. The oxygen tanks sometimes contain a pressure of 2,000 lb. to the square inch and this pressure is controlled through a reducing gauge and used at the low point of 15 lb., when the tank or bottle is returned to the gas manufacturer to be refilled again. While this method is efficient, the high pressure makes a dangerous explosive and the expense of shipping the tanks is too costly in many places for some kinds of work and therefore its use is precluded.



Cutting a Casting

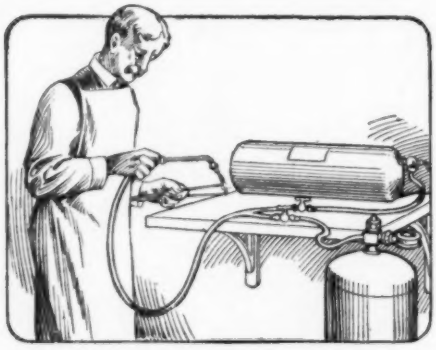


Portable Outfit

In the past three years new chemicals have come into use for making oxygen cheaply with a very simple apparatus. As it is not necessary to have more than 30 lb. pressure for welding, the gas can be stored in light steel tanks without danger. For many years acetylene gas has been generated with various kinds of apparatus and the preparing of this gas for use in connection with the oxygen is nothing more than placing the carbide in a sealed tank and applying the water automatically to keep the number of pounds pressure necessary at all times.

As the oxygen gas is now very easily

made, also, the portable welding outfits have put in their appearance and the entire machine can be hauled on its

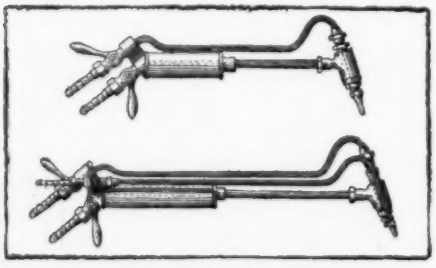


Simple Oxy-Acetylene Outfit

own wheels to any place necessary to do a piece of work.

The torch is the important part of the outfit for the success of this process. The upper pipe of the tool carries the oxygen which is used at various pressures from 8 lb. to 30 lb., the pressure being changed according to the size tips used for the thickness of the metal. The acetylene is applied to the tip through the lower pipe with a pressure of about 1 lb. per square inch; a regulator is used to reduce the pressure at the tank. The oxygen enters the tip through a small opening in a direct line of the flow, while the acetylene enters through four small openings made at right angles to the line of flow. The enlarged portion of the acetylene pipe contains porous material through which the acetylene gas must pass; this forms a convenient handle for the torch.

When cutting metals the action is a



Welding and Cutting Tools

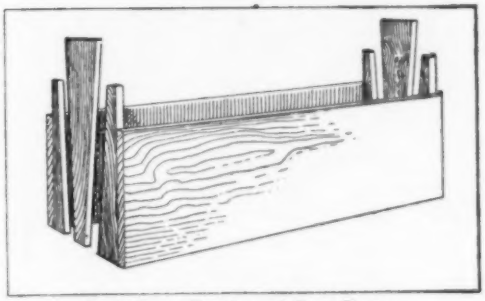
chemical one which consists of heating the metal to fusion, as in welding, and at this point the cut is started by turning on an additional stream of pure oxygen from another tank that has a pressure varying from 125 to 175 lb. per square inch. This results in a chemical union of oxygen and the carbon of the metal, the additional carbon causing a disintegration of the metal. The tool used for cutting metals is the welding tool supplied with an extra pipe for the high pressure oxygen. This pipe can be attached to and detached from the welding tool as desired. When cutting metals the oxygen is stored in the tank to the high pressure necessary and the welding tool takes its supply of oxygen through a reducing valve, while the attached cutting pipe is supplied either direct from the tank or through another reducing valve.

The autogenous weld made with oxy-acetylene is the only known method that will join aluminum so the parts will not separate with use. The flame from the burning gases purifies the metal and after making a weld the place will not be hard.

The outfits can now be purchased, or parts to make up an outfit, varying in size and construction from the simplest form to the portable machines for commercial work.

Forms for Making Hollow Concrete Walls

A wall made from hollow concrete blocks can have a dead air space without any trouble but the monolithic (one-piece) wall is not so easily constructed to have an opening between two solid walls which are joined together at intervals. Such a wall can be constructed, but it is necessary to put in layers or sections of concrete using forms to make the open space, these forms being raised for each succeeding layer. The accompanying sketch shows a form for making the hollow space between two solid walls. The height of the form should be greater than the depth of each section to be laid, and 20 to 30 in. long. The cleats on the ends of the boards are made tapering toward the top with a

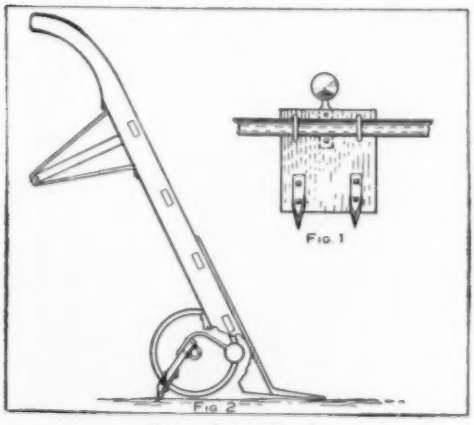


Each Form Consists of Four Parts

wedge-shaped piece having the same slope on each edge for separating and keeping the sides parallel. After the concrete for the first layer is put in and set, the forms can be raised so a part of the bottom will remain in the set concrete and the wedges placed so the next layer can be tamped in. A sufficient number of forms should be provided to extend the length of the wall being made. When starting the wall, the forms are set 5 in. apart and these spaces should have twisted wires well embedded in the concrete as it is being tamped in to tie the two sections of the wall together.—Contributed by Newton Bawn, Eagle Grove, Iowa.

A Stop for a Warehouse Truck

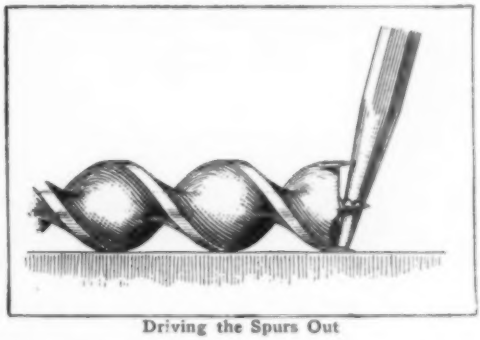
Did you ever try to put a well filled barrel or box on a warehouse truck and have the wheels back up about the time you started to tip the load on the frame? If you have, you will welcome such a device as shown in the sketch attached to your truck. Figure 1 shows the attachment as it is fastened to the axle of the truck and Fig. 2 the way the points are set into the floor with your foot when the truck is ready to be tipped in loading.



Chock for a Truck

Repairing a Worn Bit

Worn spurs on wood bits cut the hole smaller than the bit and make the twist part fit the hole tightly which crowds the feed and makes a hard working tool. The best way to remedy the worn spurs is to bend them out



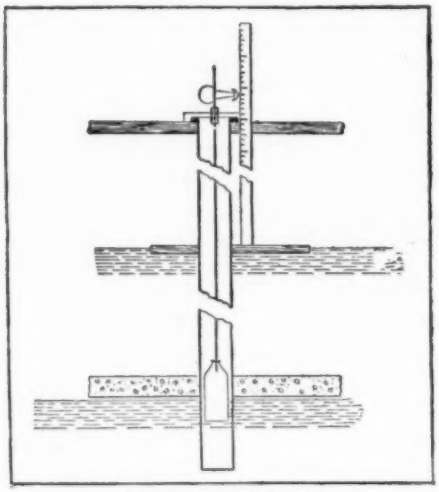
Driving the Spurs Out

with a small nail set or punch driven by a light hammer, says Blacksmith and Wheelwright. The bit is placed on a perfectly level surface and the spurs driven out so they will be a little wider than the diameter of the bit through the twist part.

Head and Tail Water Gauge

The description of a head and tail water gauge which is claimed to give the same results winter and summer is given by a correspondent of Power. The device consists of a 12-in. pipe extending from the main floor down through the wheel-pit floor, and, being cemented in this floor and open at the bottom, will communicate with the tail race only; thus a float, in this case a glass bottle, placed in this pipe will float at the height of the water below the dam, plus the back pressure. This float carries a pointer only, although it could have a scale also.

Another float made of wood and built around the pipe, carries a board which has a scale marked in feet and inches;



Details of the Gauge

this also might have a pointer attached to the floor which would give the height over the crest, except for the following reasons:

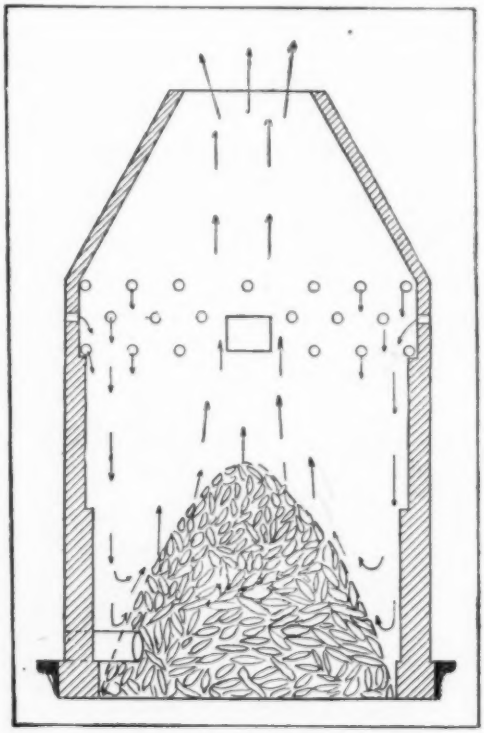
It is not advisable to try to get head and tail race readings off of this gauge, as the drop in the head race will vary with the load; the tail race also varies, due to the back pressure under the wheel-pit floor, and while there is ample room for the water to leave the wheels, this back pressure or tail-race fluctuation is considerable, so that the gauge only indicates the actual or effective head at the wheels, which, after all, is just what we want to know.

In order to ascertain the flow over the crest of the dam a similar gauge was placed about 50 ft. above the dam where it will always show the true amount of water over the crest regardless of the fall in head races. In this case, the pipe extends about 4 ft. below the crest and 6 ft. above. As this gauge is out where it would freeze, the pipe was filled with oil to a little below the freezing line, thus making the gauge available in winter as well as summer.

When mixing red lead paint use raw oil rather than boiled oil.

How to Get Rid of Cobs

Cobs will quickly accumulate around an elevator or where a great quantity of corn is shelled and will be in the way, unless sold or burned. A correspondent of the Grain Dealers' Journal describes a burner that will consume the cobs from 500 bushels of corn in one hour which is constructed as follows: The burner is built of brick 30 ft. high with an inside diameter of 16 ft., tapering at the top to an 8-ft. opening. The foundation is 2 ft. wide and 2 ft. deep. The wall is 18, 13 and 8 in. thick. An inner lining of 4 in. of the 18-in. wall is of common brick. This section of the wall is 8 ft. high; the next or second, 8 ft.; third, 4 ft.; and the top, 10 ft. The bricks in the top section are laid level, but each course is drawn in about 1 in., the bricks are not tipped at an angle. The inner 4 in. lining wall is laid in clay, but the rest in lime mortar with a little Louisville cement. The 6-in. tile vent holes are



Cob Burner

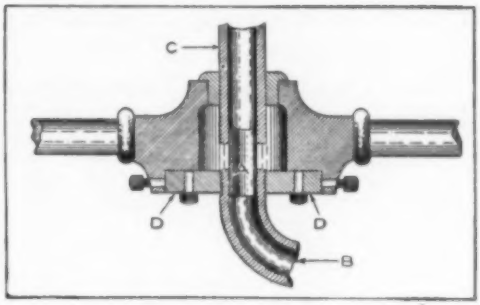
in the wall between the lines, 16 and 20 ft. from the ground, the idea being to cool the wall and divide the draft so as not to create too much suction. The section of spout next the burner is of iron and is disconnected when not running and at night for safety. The firing hole at the bottom is an 18-in. round hole built into the kiln for 2 ft. and should be kept closed. The walls are built with a header course every 18 in.

There is no grate of any kind, only a small hole at the bottom large enough for a man to crawl in and start the fire and then close it up. The cobs and dust enter in a single spout direct from the cleaner, without a conveyor of any kind. The kiln can not be over 25 ft. from the elevator, but the combustion is so perfect that no smoke, flame, dust, ashes or sparks are thrown out at the top. The spout enters about 15 ft. from the level.

The cobs soon form a cone-shaped pile in the middle of the burner. The fire creeps up the walls and forms a bed of coals. As the fire must have air, it draws it in through the tile holes in the wall. This air, being cold, falls as soon as it enters and forms a cushion of cool air between the brick wall and the cone of live coals in the center. It then passes out at the top as hot air and gas. Dust and shucks are instantly consumed as they are blown from the dust spout directly into the bed of coals, and have no chance to fly out at the top in the form of sparks. If the draft is made strong by an opening at the bottom, it will throw out pieces of burning cobs at the top. This kiln is banded with 5 or 6 straps of iron, ¼ in. thick and 4 in. wide.

Cutting Threads on Short Pipe Bends

The accompanying sketch shows a method of cutting threads on the end of a pipe or nipple that will not permit a die stock to cut them in the usual way. The die D is reversed in the stock and started on the nipple or bent pipe, B, as shown. A plug, A, is driven in the end of a pipe, C, which must

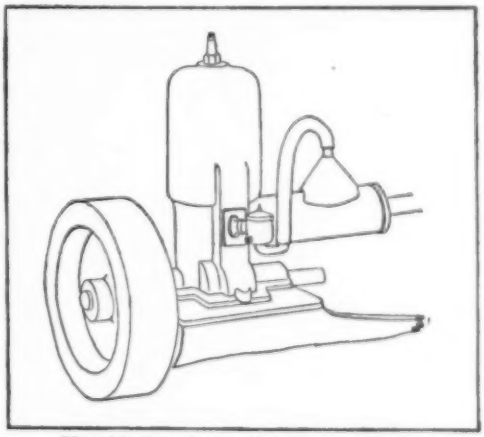


Reversing the Die to Cut Threads

be the same size as the pipe to be threaded. When turning the stock, the pipe C can be held very steady and in line with the one being threaded.—Contributed by F. Maxon, Elmira, N. Y.

Supplying Hot Air to a Carburetor

A simple way of pre-heating the air before it enters the carburetor on a gasoline engine is to take a tin funnel about 10 in. in diameter at the top and cut it to fit over the muffler, as shown in the sketch. Attach the funnel to the muffler with wire and connect the



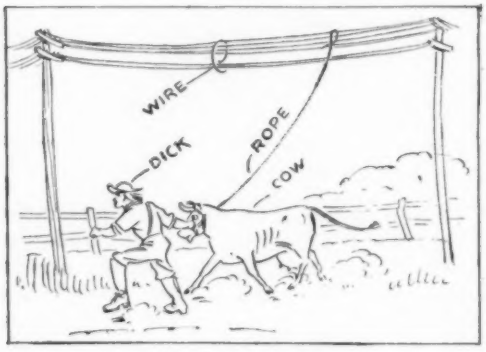
Hot Air Attachment for Gasoline Engines

small end of the funnel to the intake of the carburetor with a piece of garden hose.—Motor Boat.

Sealing wax dissolved in gasoline with a little linseed oil added to prevent brittleness will make a good varnish for automobile electric terminals.

Cow Takes Temporary Position in Maintenance Department

Here is a little story I want to tell about a "trouble-shooter" who used a



Dick and His Helper

cow to help him clear up a piece of trouble, says a correspondent of Telephony. Dick Thew is a trouble-shooter in the St. John's suburb of Portland, Oregon, and he is, of course, up against all regular kinds and some unusual types of troubles.

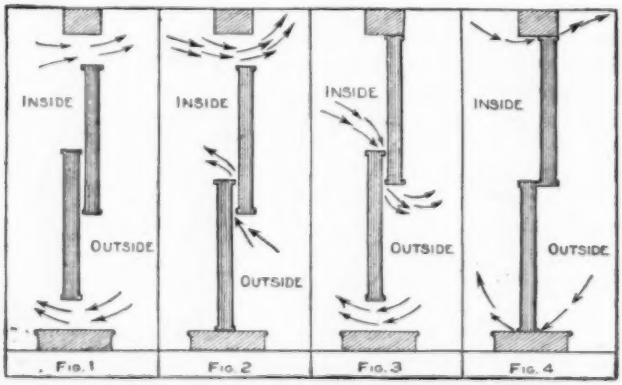
One day, not long ago, Dick was sent out on a "P. S.," and soon located a piece of hay-wire across the circuit in trouble, out in the middle of the span. He went up one of the poles and tried to shake it off, but the more he shook, the tighter it seemed to stick. Dick was "up against it," but he's a Yankee and soon spied a cow some distance off, tied to a long rope. Now Dick wanted that rope for a few minutes, and wanted it bad, but he didn't have any particular use for the cow. However, he saw no way of borrowing the one without taking the other, unless he turned her loose, and that wouldn't do. So he borrowed one end of the rope, which was all he needed and—well, of course, he was not supposed to know there was a cow on the other end, anyway—carried it up the pole, tied it to one of the wires, came down, led the cow to the next pole, went up and took off the wire and rope, returned the cow and rope to the place from whence they came, and there you are.

Dick's married now—got married last week. That's how I happened to find out about the cow. Dick told his wife, his wife told my wife and my wife told me.

Metal novelties and coffin hardware are made from lead and antimony alloy. The best for casting into moulds is one containing 13 per cent antimony.

Practical Room Ventilation

The proper ventilation of living rooms by the aid of windows is not generally understood. The accompanying sketch will show the air currents from open windows. These diagrams show the results obtained by filling a moderate sized room with smoke and then watching the entry of fresh air drive the smoke out as indicated by the direction of the arrows. The proper way is to open the window both top and bottom as in Fig. 1. In Figs. 2 and 3 the arrows show how the outgoing or incoming air is retarded by only opening one sash of the window. Even when the windows are closed tight the foul air or smoke will filter through the cracks along the top of the windows, being driven out by the entry of air through the cracks at the bottom of the window as shown in Fig. 4—Contributed by G. F. Orphal, New York City.



Showing the Air Currents Through Window Openings

Home-Made Babbitt File

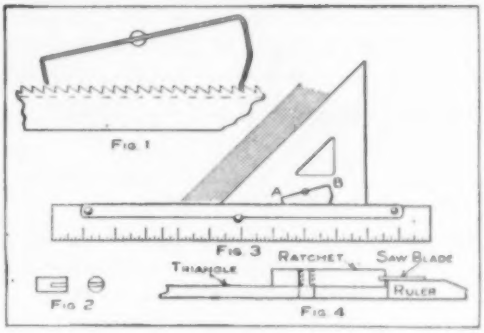
Take a piece of ½-in. cold rolled steel about 16 in. long and cut a good sharp thread on its length excepting 2 in. on one end for a place to fasten a handle, says a correspondent of American Machinist. This makes a superior tool to the ordinary file for filing babbitt, as it does not fill up and is cheaper.

Catching the Drippings from an Oil Can Spout

After using an oil can, the drippings from the spout will always run down on the outside making it an oily thing to handle the next time and keeping the place where the can sets well soaked in oil. A little device made from an old gas burner and put on the spout as shown in the illustration will prevent the drippings from running over the can. The threaded end is cut off from an old gas burner and then the piece is driven on the oil can spout and soldered to keep it in place. The small opening in the burner will catch the oil and save it, at the same time keeping the can neat and clean.

Home-Made Section Liner

A machine for doing neat and even cross-section lining may be easily constructed from a hacksaw blade, ruler and triangle, as shown in the sketch. Fasten a rather fine tooth hacksaw blade to the top of a wooden ruler or other straight strip of wood by means of brass tacks so that the edge having the teeth will project over the edge of the wood. Bend a ¼-in. strip of steel or brass into the shape shown in Fig. 1 and fasten to its middle a pivot made by sawing a slot in a piece of wire, Fig.



Details of the Liner

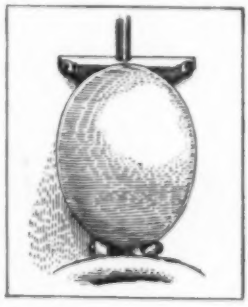
2. Drill a hole in a 45-deg. triangle near the edge to fit the pivot snugly.

Put these parts together as shown in Figs. 3 and 4. By pressing alternately on A and B with the second and third fingers of the left hand the triangle will move across the paper in a series of equal steps and the pen may be used in the usual manner. The distance the lines may be made apart is varied by the number of steps taken by the ratchet between each stroke of the pen.

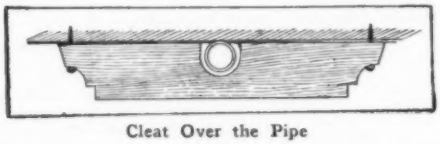
Needle points should be placed at both ends and on the under side of the ruler to keep it from slipping. The ratchet may be used on any triangle by simply drilling the small hole near the edge, which will not in any way interfere with the use of the triangle for other purposes.

Preventing a Closet Flush Pipe from Denting

The pipe carrying the water for flushing a soil basin usually becomes badly dented from throwing the cover back against the pipe. This may be prevented by cutting out a piece of wood to fit over the pipe and fastening it to the wall with screws. The accompanying sketches show how the piece of wood



is fastened over the pipe and the position for it to be placed to catch the edge



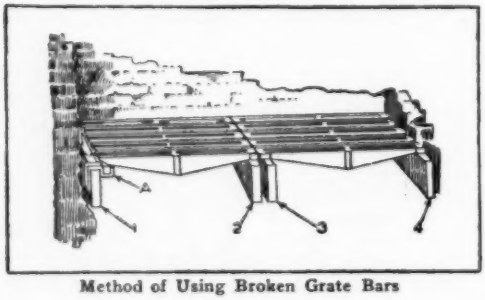
Cleat Over the Pipe

of the cover at the point where the pipe is liable to be dented.—Contributed by H. Grahamann, Milwaukee, Wis.

Using Broken Grate Bars in a Ship's Boiler

A large vessel set out on her way back from the Far East, headed for New York and after a day out the store room keeper found that the stock of grate bars on hand consisted of only 18 bars. Nearly 6,000 knots to make with 465 sq. ft. of grate bar surface in use and only 18 bars on hand. The fireboxes of the boilers were constructed to use the regular type of double bar, 36 in. long, with two lengths for a furnace 6 ft. 7 in., or 72 bars wide, resting on four bearing bars shown by 1, 2, 3 and 4 in the illustration. As almost all bars break at the shoulder near the end, improvised bearings, A, were provided. These bearings were forged of ½ by 2-in. iron and hung on bearing bars which supported a 1-in. square steel bar the entire length of the bearer and of the right height for the broken end of a grate bar to rest on the bar and be at the same time as level at the top as a good one.

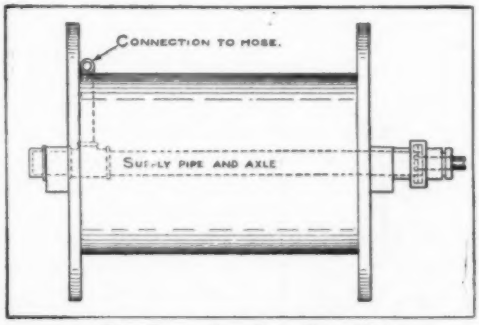
As the front row in each furnace contained 72 bars, three boilers were fixed as described, allowing the use of 216 broken bars, consequently giving 216 good bars taken from where broken ones were installed, says a correspondent of American Marine Engineer. The 6,000 miles were made with no inconvenience, having 4 spare grate bars left when New York was reached.



Method of Using Broken Grate Bars

A Hose Reel

A very convenient hose reel for keeping the hose in good shape is shown in the accompanying sketch. The reel turns on a 1-in. pipe which has a stuffing box joint between it and the union. The hose is always connected to the supply pipe and ready for use as soon as it is run off the reel, says a correspondent of Power. The reel is supported by two brackets which may be fastened to the wall in a place easily accessible.



Pipe Connections for a Hose Reel

How to Find the Cylinder Missing Fire

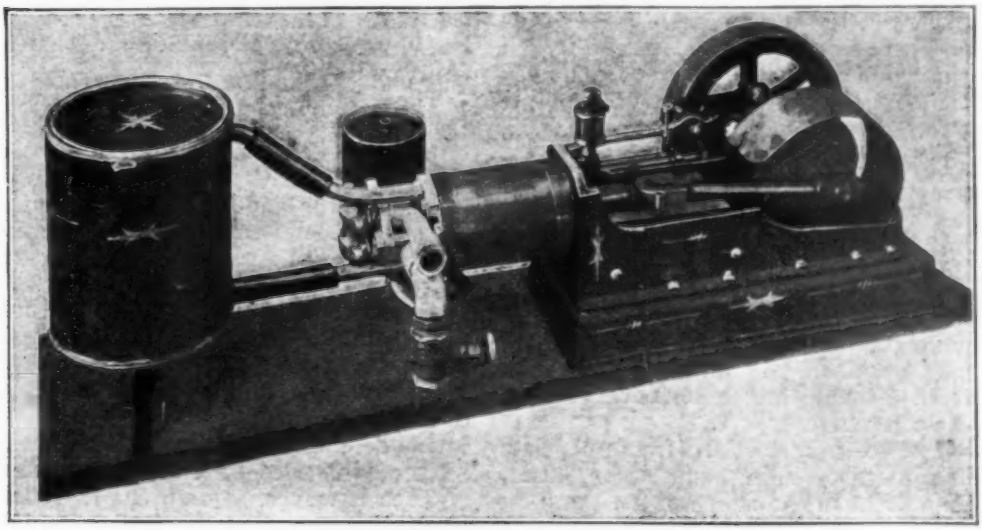
One cylinder missing fire in a set of 4 or 6 cylinders on an automobile is a very hard thing to locate. Usually the engine misses fire when under load and will act properly when running free where it can be watched. After running for a time, the offending cylinder can be quickly located by stopping the engine and touching each cylinder with the business end of a match, says the Automobile. The cylinders which are hot from action will ignite the match and the one missing fire will not.

AMATEUR MECHANICS

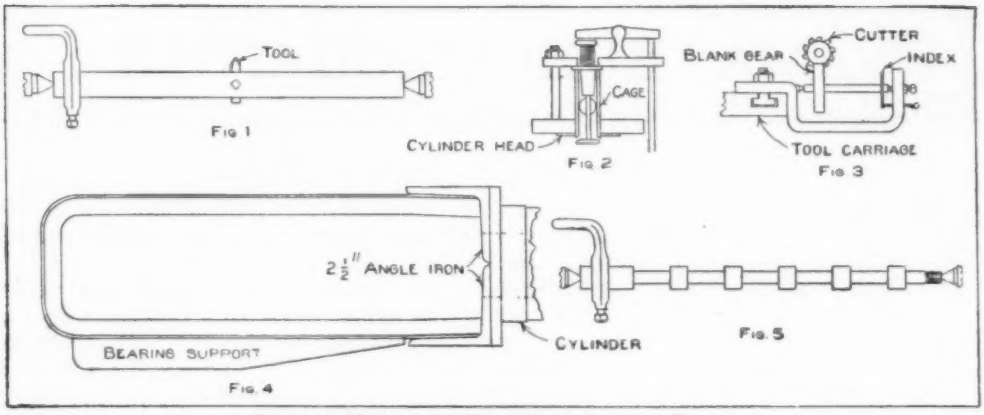
Home-Made 1-4-Hp. Gasoline Engine

The material used in the construction of the gasoline engine, as shown in the accompanying picture, was pieces found in a scrap pile that usually occupies a fence corner on almost every farm. The cylinder consists of an old pump cylinder ⅜ in. thick, 1¾ in. inside diameter and about 5 in. long. This was fastened between some wooden blocks which were bolted on the tool carriage of a lathe and then bored out to a diameter of about 2 in. The boring bar, Fig. 1, consisted of an old shaft with a hole bored through the center and a tool inserted and held for each cut by a set screw. A wood mandrel with a metal shaft to turn in the centers of a lathe was made to fit the bored-out cylinder. The cylinder was then placed on the mandrel, fastened with a pin, and threaded on both ends. Flanges were next made from couplings discarded from an old horse power tumbling rod, to fit on the threaded ends of the cylinder casting. When these flanges were tightly screwed on the casting and faced off smooth it presented the appearance of a large spool.

The back cylinder head was made from a piece of cast iron about ½ in. thick, turned to the same diameter as the flanges, and with a small projection to fit snugly inside of the cylinder bore. Two holes were then drilled in this head and tapped for ¾-in. pipe. Two pieces of ¾-in. pipe were fitted to these holes so when they were turned in, a small part of the end of each pipe projected through on the inside of the cylinder head. These pieces of pipe serve as valve cages and are reamed out on the inside ends to form a valve seat. The outlet for the exhaust and the inlet for the gas and air passes through holes drilled in the side of each pipe respectively and tapped for ½-in. pipe. Two heads were then made to fit over the outer ends of the valve cages. These heads look similar to a thread spool with one flange cut off, the remaining flange fitting on the



Complete Home-Made Gasoline Engine



Steps in Making the Home-Made Gasoline Engine

end of the valve cage and the center extending down inside to make a long guide for the valve stems. These heads are held in place by a wrought-iron plate and two bolts, one of which is plainly shown in the picture. This plate also supports the rocker arms, Fig. 2, and the guides for the rods that operate the valves. Both valves are mechanically operated by one cam attached to a shaft running one turn to two of the crankshaft. The gears to run this shaft were cut from solid pieces on a small home-made gear-cutting attachment for the lathe as shown in Fig. 3. The gear on the crankshaft has 20 teeth meshing into a 40-tooth gear on the cam shaft.

The main part of the frame consists of a piece of ½-in. square iron, 30 in. long, bent in the shape of a U, and on the outside of this piece is riveted a bent piece of sheet metal ⅛ in. thick and 3 in. wide. The U-shaped iron is placed near one edge of the sheet metal. Two pieces of 2½-in. angle iron are riveted vertically on the ends of the U-shaped iron and a plate riveted on them to close the open end and to form a face on which to attach the cylinder with bolts or cap screws. A hole was cut through the angle irons and plate the same size as the bore of the cylinder so the piston could be taken out without removing the cylinder. A 1-in. angle iron was riveted to one side of the finished frame to make a support for the crankshaft bearing. The rough frame, Fig. 4, was then finished on an emery wheel. This long frame had to be made to accommodate the crosshead which was necessary for such a short cylinder.

The piston and rod were screwed together and turned in one operation on a lathe. The three rings were made from an old cast-iron pulley. The cap screws were made from steel pump rods. A piece of this rod was centered in a lathe and turned so as to shape six or more screws, Fig. 5, then removed and the first one threaded and cut off, then the second and so on until all of them were made into screws. The rod was held in a vise for this last operation. Studs were made by threading both ends of a proper length rod. Make-and-break ignition is used on the engine; however, a jump spark would be much better. The flywheel and mixing valve were purchased from a house dealing in these parts. The water jacket on the cylinder is a sheet of copper formed and soldered in place, and brass bands put on to cover the soldered joints.—Contributed by Peter J. Johnson, Clermont, Iowa.

If gasoline drips from the carburetor when the engine is not running, the needle valve connected with the float should be investigated. If the dripping stops when the valve is pressed down, the float is too high. If the valve keeps dripping, then it should be ground to a fit.

A Film Washing Trough

The washing of films without scratching them after they are developed and fixed is very difficult in hot weather. A convenient washing trough for washing full length films is shown in the accompanying sketch. The trough must be made for the size of the film to be washed. Cut a ¼-in. board as long as the film and a trifle wider than the film's width. Attach strips to the edges of the board to keep the water from spilling over the sides.

Cut a hole in one side of a baking-powder can about half way between the top and bottom, large enough to admit a fair-sized stream of water from a faucet. Then solder the cover to the can and punch a number of holes about ¼ in. apart along the opposite side from where the large hole was cut. Place this can on one end of the trough, as shown, with the large hole up.

Some heavy wire bent in the shape of a U and fastened to the under side of the trough at the can end will furnish supports to keep that end of the trough the highest and place the opening in the can close beneath the water faucet. A common pin stuck through one end of the film and then in the trough close to the can will hold it in position for washing. Five minutes' washing with this device is sufficient to remove all traces of the hypo from the film.—Contributed by M. M. Hunting, Dayton, O.

Washing a Negative Film

Burnt wood work done with an ordinary reading glass and the sun's rays.

The Diving Bottle

This is a very interesting and easily performed experiment illustrating the transmission of pressure by liquids. Take a wide-mouthed bottle and fill almost full of water; then into this bottle place, mouth downward, a small vial or bottle having just enough air in the bottle to keep it barely afloat. Put a sheet of rubber over the mouth of the large bottle, draw the edge down over the neck and wrap securely with a piece of string thus forming a tightly stretched diaphragm over the top. When a finger is pressed on the rubber

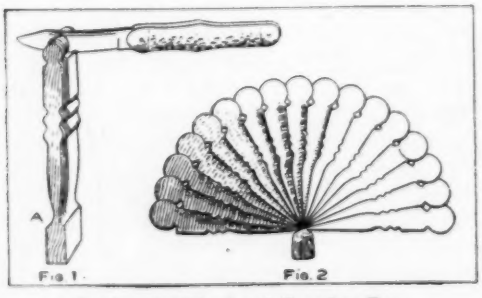
the small bottle will slowly descend until the pressure is released when the small bottle will ascend. The moving of the small bottle is caused by the pressure transmitted through the water, thus causing the volume of air in the small tube to decrease and the bottle to descend and ascend when released as the air increases to the original volume.

Pressure Experiments

This experiment can be performed with a narrow-necked bottle, provided the bottle is wide, but not very thick. Place the small bottle in as before, taking care not to have too much air in the bottom. If the cork is adjusted properly, the bottle may be held in the hand and the sides pressed with the fingers, thus causing the small bottle to descend and ascend at will. If the small bottle used is opaque, or an opaque tube such as the cap of a fountain pen, many puzzling effects may be obtained.—Contributed by John Shahan, Auburn, Ala.

How to Make an Inexpensive Wooden Fan

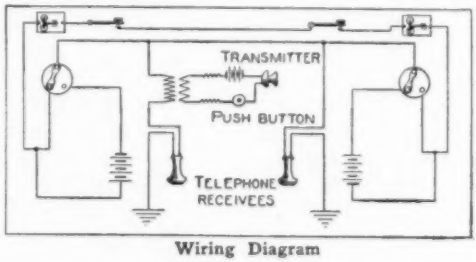
Select a nice straight-grained piece of white pine about ¼ in. thick, ¾ in. wide and 4 in. long. Lay out the design desired and cut as shown in Fig. 1, and then soak the wood in hot water to make it soft and easy to split. Cut the divisions very thin with a sharp knife down to the point A, as shown in the sketch, taking care not to split the wood through the part left for the handle. The fan is then finished by placing each piece over the other as in Fig. 2. This will make a very pretty ornament.—Contributed by Fred W. Whitehouse, Upper Troy, N. Y.



Cutting the Wood and Complete Fan

Combination Telegraph and Telephone Line

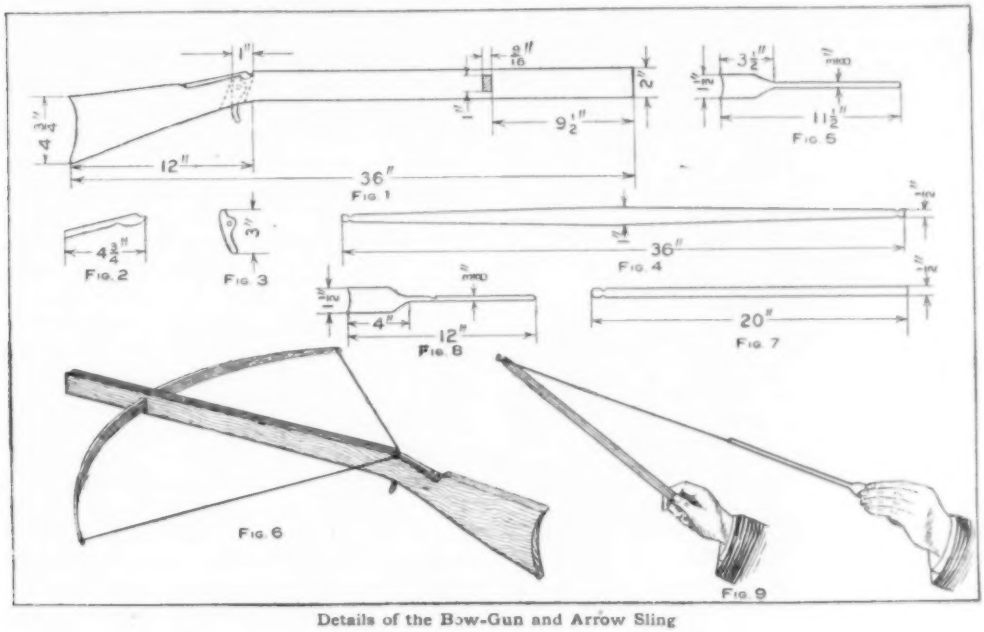
The accompanying diagrams show connections for a short line system (metallic circuit) of telegraph where a telephone may be used in combination on the line. The telephone receivers can be used both as receivers and transmitters, or ordinary telephone transmitters, induction coils and battery may be used in the circuit with a receiver. If a transmitter is used, its batteries may be connected in circuit with a common push button which is held down when using the telephone. On a 1000-ft. line, four dry cells will be sufficient for the telegraph instruments and two cells for the telephone.—Contributed by D. W. Miller.



Wiring Diagram

How to Make a Crossbow and Arrow Sling

In the making of this crossbow it is best to use maple for the stock, but if this wood cannot be procured, good straight-grained pine will do. The material must be 1½ in. thick, 6 in. wide and a trifle over 3 ft. long. The bow is made from straight-grained oak, ash, or hickory, ⅝ in. thick, 1 in. wide and 3 ft. long. A piece of oak, ⅜ in. thick, 1½ in. wide and 6 ft. long, will be sufficient to make the trigger, spring and arrows. A piece of tin, some nails and a good cord will complete the materials necessary to make the crossbow.



Details of the Bow-Gun and Arrow Sling

The piece of maple or pine selected for the stock must be planed and sandpapered on both sides, and then marked and cut as shown in Fig. 1. A groove is cut for the arrows in the top straight edge ⅜ in. wide and ⅜ in. deep. The tin is bent and fastened on the wood at the back end of the groove where the cord slips out of the notch; this is to keep the edges from splitting.

A mortise is cut for the bow at a point 9½ in. from the end of the stock, and one for the trigger 12 in. from the opposite end, which should be slanting a little as shown by the dotted lines. A spring, Fig. 2, is made from a good piece of oak and fastened to the stock with two screws. The trigger, Fig. 3, which is ¼ in. thick, is inserted in the mortise in the position when pulled back, and adjusted so as to raise the spring to the proper height, and then a pin is put through both stock and trigger, having the latter swing quite freely. When the trigger is pulled, it lifts the spring up, which in turn lifts the cord off the tin notch.

The stick for the bow, Fig. 4, is dressed down from a point ¾ in. on each side of the center line to ½ in. wide at each end. Notches are cut in the ends for the cord. The bow is not fastened in the stock, it is wrapped with a piece of canvas 1½ in. wide on the center line to make a tight fit in the mortise. A stout cord is now tied in the notches cut in the ends of the bow making the cord taut when the wood is straight.

The design of the arrows is shown in Fig. 5 and they are made with the

blades much thinner than the round part.

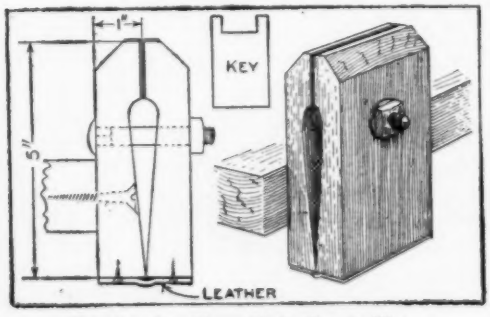
To shoot the crossbow, pull the cord back and down in the notch as shown in Fig. 6, place the arrow in the groove, sight and pull the trigger as in shooting an ordinary gun.

The arrow sling is made from a branch of ash about ½ in. in diameter, the bark removed and a notch cut in one end, as shown in Fig. 7. A stout cord about 2½ ft. long is tied in the notch and a large knot made in the other or loose end. The arrows are practically the same as those used on the crossbow, with the exception of a small notch which is cut in them as shown in Fig. 8.

To throw the arrow, insert the cord near the knot in the notch of the arrow, then grasping the stick with the right hand and holding the wing of the arrow with the left, as shown in Fig. 9, throw the arrow with a quick slinging motion. The arrow may be thrown several hundred feet after a little practice.—Contributed by O. E. Trownes, Wilmette, Ill.

A Home-Made Vise

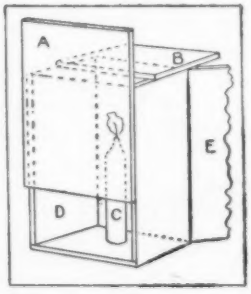
Cut two pieces of wood in the shape shown in the sketch and bore a ⅜-in. hole through both of them for a common carriage bolt. Fasten one of the pieces to the edge of the bench with a large wood screw and attach the other piece to the first one with a piece of leather nailed across the bottom of both pieces. The nut on the carriage bolt may be tightened with a wrench, or, better still, a key filed out of a piece of soft steel to fit the nut. The edges of the jaws are faced with sheet metal which can be copper or steel suitable for the work it is intended to hold.



Details of a Home-Made Bench Vise

Temporary Dark Room Lantern

Occasionally through some accident to the regular ruby lamp, or through the necessity of developing while out of reach of a properly equipped dark room, some makeshift of illumination must be improvised. Such a temporary safe light may be made from an empty cigar box in a short time.



Remove the bottom of the box, and nail it in position as shown at A. Remove one end, and replace as shown at B. Drive a short wire nail through the center of the opposite end to serve as a seat for the candle, C. The lamp is finished by tacking two or more layers of yellow post-office paper over the aperture D, bringing the paper well around to the sides and bottom of the box to prevent light leakage from the cracks around the edges, says Photo Era. The hinged cover E, is used as a door, making lighting and trimming convenient. The door may be fastened with a nail or piece of wire. It is well to reinforce the hinge by gluing on a strip of cloth if the lamp is to be in use more than once or twice. This lamp is safe, for the projecting edges of A and B form light-shields for the ventilation orifice and the crack at the top of the hinged cover, respectively. Moreover, since the flame of the candle is above A, only reflected and transmitted light reaches the plate, while the danger of igniting the paper is reduced to a minimum.

The paint will sag and run if too much oil is put in white lead.

Old-Time Magic—Part VI

A Handkerchief Mended after Being Cut and Torn

Two persons are requested to come forward from the audience to hold the four corners of a handkerchief. Then beg several other handkerchiefs from the audience and place them on the one held by the two persons. When several handkerchiefs have been accumulated, have some one person draw out one from the bunch and examine for any marks that will determine that this handkerchief is the one to be mended after being mutilated. He, as well as others, are to cut off pieces from this handkerchief and to finally tear it to pieces.

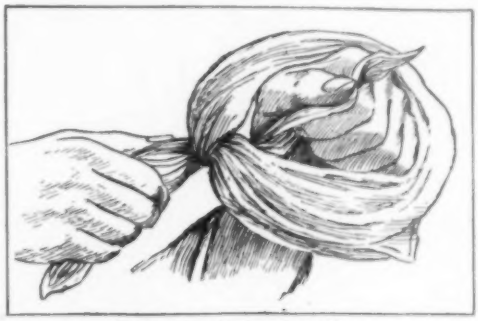
The pieces are then all collected and some magic spirits thrown over the torn and cut parts; tie them in a small package with a ribbon and put them under a glass, which you warm with your hands. After a few seconds' time, you remove the glass, as you have held it all the time, and take the handkerchief and unfold it; everyone will recognize the mark and be amazed not to find a cut or tear in the texture.

This trick is very simple. You have an understanding with some one in the company, who has two handkerchiefs exactly alike and has given one of them to a person behind the curtain; he throws the other, at the time of request for handkerchiefs, on the handkerchiefs held for use in the performance of the trick. You manage to keep this handkerchief where it will be picked out in preference to the others, although pretending to thoroughly mix them up. The person selected to pick out a handkerchief naturally will take the handiest one. Be sure that this is the right one.

When the handkerchief has been torn and folded, put it under the glass, on a table, near a partition or curtain. The table should be made with a hole cut through the top and a small trap door fitted snugly in the hole, so it will appear to be a part of the table top. This trap door is hinged on the under side and opens into the drawer of the table and can be operated by the person behind the curtain who will remove the torn handkerchief and replace it with the good one and then close the trap door by reaching through the drawer of the table.

The Magic Knot

This is a very amusing trick which consists of tying one knot with two ends of a handkerchief, and pulling the ends only to untie them again. Take the two diagonal corners of a handkerchief, one in each hand and throw the main part of the handkerchief over the wrist of the left hand and tie the knot as shown in the illustration. Pull the ends quickly, allowing the loop over the left hand to slip freely, and you will have the handkerchief without any knot.



Tying and Untying a Knot

A Good Mouse Trap

When opening a tomato or other small can, cut the cover crossways from side to side making four triangular pieces in the top. Bend the four ends outward and remove the contents, wash clean and dry and then bend the four ends inward, leaving a hole about ¾ in. in diameter in the center. Drop in a piece of bread and lay the can down upon its side and the trap is ready for use. The mouse can get in but he cannot get out.—Contributed by E. J. Crocker, Victor, Colo.

Rubbing the surface of an aluminum plate with a steel brush will produce a satin finish.

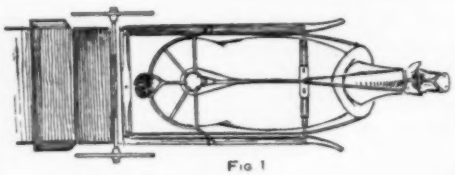


Fig. 1

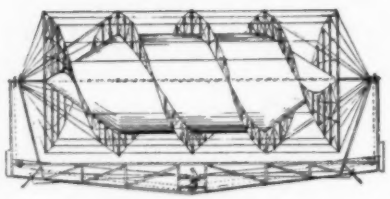


Fig. 2

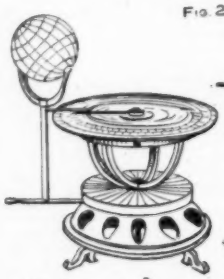


Fig. 3

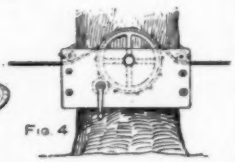


Fig. 4

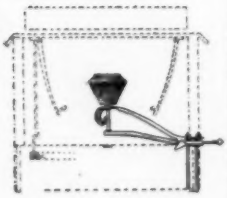


Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

RECENT

HARNESS AND VEHICLE RELEASING DEVICE.—The harness arrangement shown in Fig. 1 is provided with trip straps, by the pulling of which the horse can be released from the harness, or the harness and horse released from the vehicle. If equipped with such an arrangement, a horse threatens to become unmanageable while women or children are occupying the vehicle, the animal can be released.

CORK-SCREW AIRSHIP.—The airship patent illustrated in Fig. 2 is of interest because of its originality. From a central shaft is a series of radiating spokes around which is the gas bag. Outside this rigid gas envelope is a spiral blade, fastened to the projecting ends of the spokes. The shaft, gas bag, and spiral blade rotate, and it is the resistance against the air of the spiral blade that will be depended upon to drive the machine upward and forward. The power plant is in the center of the car which hangs below.

GEOGRAPHIC-MATHEMATICAL APPARATUS.—The apparatus designated as Fig. 3 is designed to aid in educational mathematical work as regards longitude and latitude in indicating time. It consists of a compass disc having marks indicating degrees of longitude, and a time-indicating disc arranged centrally of the compass disc and adjustable relatively thereto. The time-indicating disc bears two sets of numerals from 1 to 12 inclusive, to indicate the 24 hours of a day. The ring encircling the compass disc and adjustable to it, has a zero mark, degree-indicating marks, and distance-indicating tables opposite the degree marks.

GRIP-WHEEL FOR HAULING PURPOSES.—Such a device as shown in Fig. 4 should be of considerable value on forest lands or in any place where it becomes necessary to drag heavy objects short distances. It is especially designed, however, for logging purposes, and consists of a metal frame, which is made fast to a stump, and in which a grip-wheel is revolved by a crank.

TYPE-CLEANER FOR TYPEWRITERS.—Keeping the type of a typewriting machine clear of dirt is a task which occupies several minutes every morning, if the machine is to be kept in good working order. The device illustrated in Fig. 5 makes the task a simple one. It consists of a shaft which can be swung in or out of position at will. This shaft bears a brush, against which, when in position, the type are driven by striking the keys of the machine, as in writing. The faces of the type rub against the bristles, this action causing the brush to revolve.

DEVICE TAKES AIR FROM FIRE HOSE.—The idea shown in Fig. 6 is the invention of a Denver man who believes he has solved the problem of furnishing fresh air to firemen. His device consists of a double air chamber fitted over the tip of a fire nozzle. The air carried by the water is accumulated in the inner compartment of the chamber. It then passes from this chamber to an auxiliary chamber whose body portion is separated from the main air chamber but whose forward extremity is in communication with it, and thence through a small hose to the mask worn by the fireman.

INFANT'S PORTABLE HIGH-CHAIR.—Following close upon the success of the collapsible perambulator comes the collapsible high-chair, the idea in both being the making it possible to carry them on train or street car journeys. Fig. 7 shows a portable high-chair which can be folded into a small enough bundle to place in a suit case or carry as a bundle.

TRICK SPANKING MACHINE.—Devices of all kinds and descriptions have been invented by which lovers of jokes can get the best of their confiding friends. The machine illustrated in Fig. 8 is of that kind. Apparently it is a lifting machine, but when a person steps upon it and clasps the lifting handles the real action commences. The lifting of the handles switches in a current of electricity which makes it impossible for the person lifting to let go of the handles, and at the same time starts the spanker.

HAMMER PROVIDED WITH SHINGLE-CUTTER.—The least number of separate tools required in shingling a roof, the better is the worker's equipment, the slanting roof lending itself badly as a place to lay tools. The carpenter's hammer shown in Fig. 9 is provided with a blade that can be used for cutting shingles, thus combining two necessary tools in one.

PATENTS

PASSING CABLES THROUGH PIPE LINES.—The passing of a cable through pipes filled with running liquid and from which other pipes run downward is not the simplest task in the world, and many devices, one of which is shown in Fig. 10, have been invented to make it possible, it often being necessary to run cables through such pipe to draw cleaners through. The device illustrated is composed of a series of cups which are made fast around the cable. They are called propellers, because the water, striking against them, carries them along through the pipe. The ball attachment at the head of the cable, being lighter than the liquid, keeps always to the top of the pipe, thus guiding the cable through and assuring that it will not leave the main line for connecting pipes.

WRINKLE ERADICATOR.—Strips of court plaster are often used by woman students during night study to keep wrinkles from making their appearance. The strips are stretched across the forehead and downward just back of the temples, these points being the most likely to wrinkle from concentration and mental activity. The mask shown in Fig. 11, however, is designed to be worn on retirement at night and its mission is to prevent new wrinkles and remove old ones from under the eyes, and around the mouth, cheeks and nose. It is composed of two rigid plates adjustably connected across the nose, each plate having an extended portion fashioned to fit the contour of the face beneath the eyes, and of sufficient length to extend over the cheeks and down each side of and below the mouth.

COMBINATION CHAIR AND CENTER-TABLE.—Chairs are made to be convertible into almost any kind of household furniture, the one illustrated in Fig. 12, being a Morris chair that can be changed into a table. In its ordinary position the back is like that of any other Morris chair, but when the chair is required as a table instead of a seat, this back is drawn forward, the foot rest is straightened up, and the result is a solidly supported and smooth table top.

MEASURING THE BUOYANCY OF BALLOONS AND AIRSHIPS.—To ascertain the buoyancy of balloons and dirigible airships, sometimes a somewhat difficult task, is the province of the device in Fig. 11. It consists of a conduit running between two anchored posts. A cable, attached to a support, passes through the conduit and is made fast to the balloon or airship. The lifting power exerted on the cable is recorded on the scale.

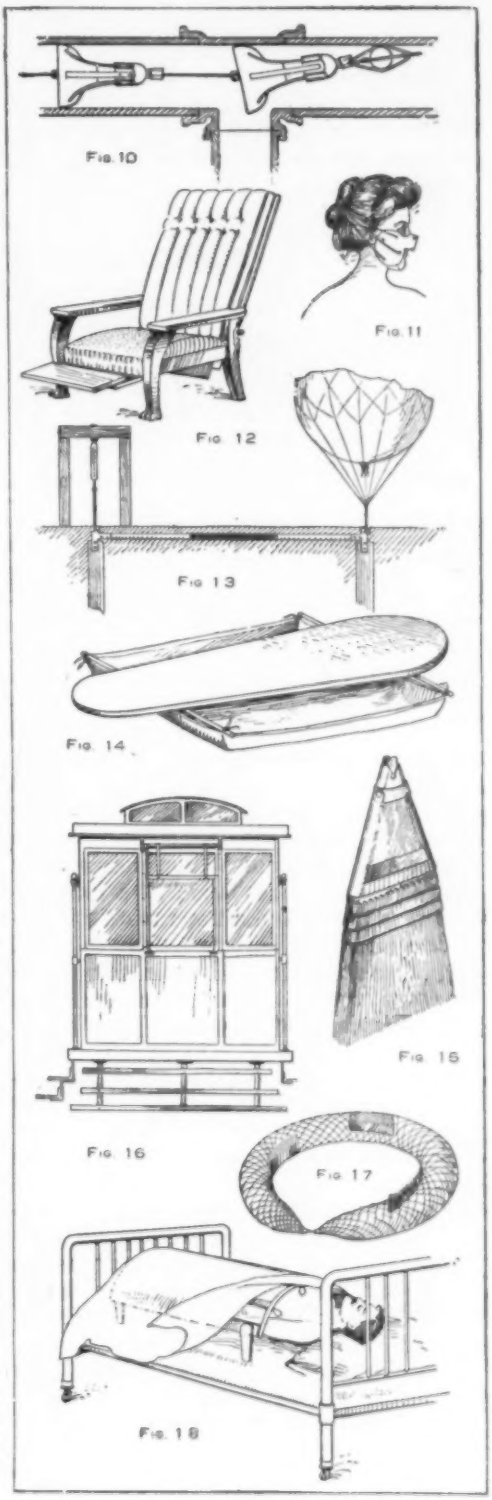
IRONING-BOARD ATTACHMENT.—In ironing clothes and pressing suits the garments, especially if long, often drag on the floor. The attachment illustrated in Fig. 14 makes this impossible, the ends of the garments dropping into the apron suspended underneath.

MOISTENING DEVICE FOR BROOMS.—Fig. 15 shows an automatic moistening device for use on brooms. It comprises a receptacle encircling the broom at the intersection of the handle with the head and containing water, and a cap of textile material which surrounds the head of the broom. The water runs from the receptacle into this cap and is evenly distributed to all parts of the broom in proper quantities.

WINDOW-CLEANING DEVICE.—On rainy days the window in front of the motorman of a street car becomes covered with mud, and on cold winter days with ice, both instances making some method of cleaning necessary. Such a means is shown in Fig. 16. It consists of a rubber strip which is run up and down the outer surface of the window. The roller can be operated by the motorman from within the vestibule.

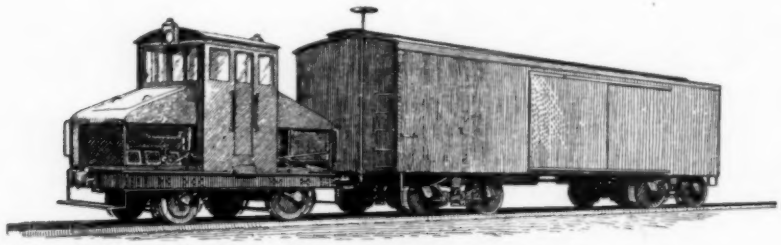
COMBINED HAIR-ROLL AND COMB.—Fig. 17 is a combined hair-roll and comb attachment, three combs being fastened to it in such a way that, when fixed in the hair, there is no danger of the roll becoming loose or out of place, an incident that often occurs.

ELECTRIC-LIGHT BATH APPLIANCE.—The device shown in Fig. 18 is an electric-light bath apparatus. It is composed of a long curved reflector that is placed around and above the body of the person being treated, completely covering it. Electric lamps are carried on the under side of the reflector, and over it is placed a spread or blanket to confine the heat from the lamps.



GASOLINE-DRIVEN SWITCHING LOCOMOTIVE

The gasoline-driven locomotive as shown in this illustration develops 75 hp. at 400 revolutions of the engine per minute, and is of the type now rapidly coming into use for switching cars in the yards of large manufacturing plants. Often switching is required only four or five hours daily, and when steam engines are used it is necessary to keep up fires for about 11 hours to perform this work. With the gasoline locomotive there is, of course, only fuel consumption during actual running.



Courtesy Anderson Engine Co.

Powerful Gasoline Locomotive

This locomotive uses from 60 to 65 gal. of gasoline in 10 hr. steady running at full capacity, but usually no more than 30 gal. is required for such steady service, as at times when the locomotive is running light the throttle is retarded and very little gasoline is used. The transmission is made for three speeds of from 3 to 40 miles an hour, either forward or reverse.

REVOLVING DOORS SWUNG BY ELECTRICITY

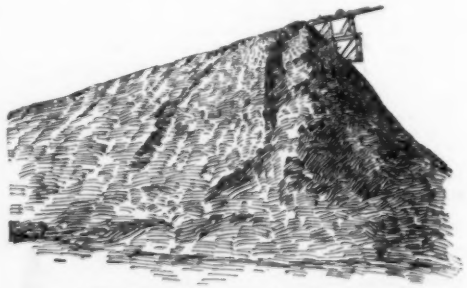
The revolving doors leading into the Hotel Astor in New York, which used to require the entire strength of a doorman to swing, are now swung by simply pressing a button. The doorman stands in the lobby some distance from the doors, and in his hand he holds an electric button attached to a wire. When a person approaches from either the street or the lobby the button is pressed and the door-swinging apparatus brought into play.

SIXTEEN-INCH GUN BUILT BY UNITED STATES

A 16-in. gun, the largest in existence today in the whole world, has been built for the United States army and temporarily mounted at Sandy Hook. It is proposed to ship the gun to the Philippines and mount it on Corregidor island for the defense of Manila. The 12-in. guns are not powerful enough to completely command the channel, but this new gun would deliver a blow 11,000 ft., which, if it got fairly home, would probably disable any modern battleship.

HUGE PILE OF SLACK BURNING INTERNALLY

Although external evidence does not carry out the assertion, this huge pile of slack, more than 100 ft. high, has been burning internally almost since the time the pile was started. It is the deposit of one of the coal washers at Pana, Ill., and it has been named Mt. Schuyler, after the mayor of Pana, who refused to have the slack removed.



Fire Smolders in This Slack Pile

GREATEST MONTH OF AERIAL NAVIGATION

This is a strenuous age. Events are continually breaking the speed limit with a consistency that makes the brains of the recorders of living, growing history reel with the absurdity of trying to keep even with the evolution. Once upon a time, it was possible for a monthly or even a bi-monthly publication to keep pace with progress, to tell the world of one great feat of accomplishment before another dwarfed it into insignificance as nothing more than one step leading to a greater one, but this is now difficult.

France has demonstrated that she can visit England in an aeroplane, Orville Wright has broken one world record and all American records, Curtiss has demonstrated that there is more than one great type of aeroplane in America, Zeppelin continues to fly regardless of accidents. All this occurred during the month of July, but, is it safe to say July is the "Greatest Month of Aerial Navigation" without qualifying it by saying "up to July"? Hardly! Before this magazine reaches the public, and this is written the very last moment before it goes on the presses, part of August will have elapsed. During that period of time between editor and reader France may fly from Calais to London, Zeppelin circle Germany, or Wright break records by hours.

However, right now—not this day, or hour, or minute—but at this very moment, 8:30:06 o'clock Thursday morning, July 29, '09, it is safe to insist that the flight of Louis Bleriot from Calais, France, to Dover, England, across the most turbulent stretch of water in the world, is the greatest accomplishment of the heavier-than-air flying-machine.

It is true that much longer flights have been made, but the distance has usually been a stretch of level, treeless field, no more than a mile square, around and around which the machines have circled until it was felt advisable to come down, or the wind freshened, or the engine hesitated. The neccessity of coming down would not have been as easy as this to Louis Bleriot, as Herbert Latham demonstrated the following day, but more of him later.

Just what Bleriot demonstrated (the world knew it could be done, but the actual doing was required) was, in the words of a French editorial, that Great Britain is no longer an impregnable fortress, of which the garrison could intervene in European wars without uneasiness, because of her splendid isolation. Instead, the straits of Calais, which were so wide at the time of Napoleon's camp at Boulogne and afterwards were narrowed by the development of steamships and submarines, will now soon be practically filled.

THE FLIGHT FROM FRANCE TO ENGLAND

It was early in the morning of July 25 that Louis Bleriot crossed the English channel in his aeroplane, a date in history which will go down to the centuries to come as one full of importance in the annals of science and civilization. Bleriot arose at Calais about 2 o'clock, and, accompanied by his friend Leblanc, drove in a motor car to Baraques, where the aeroplane was housed. The weather was favorable, and at 4 o'clock Bleriot took his seat in the aeroplane and made a trial flight of about 15 minutes around Calais. His circuits totaled about 9½ miles, and at the end he descended upon the spot on the cliff from which he had determined to start. He then waited a few minutes for the sun to come out, as the conditions of the $5,000 prize required that the flight should be made between sunrise and sunset. At 4:30 the sun appeared. A light breeze from the southwest was beginning to blow. The story of the actual flight is best told by Bleriot himself:

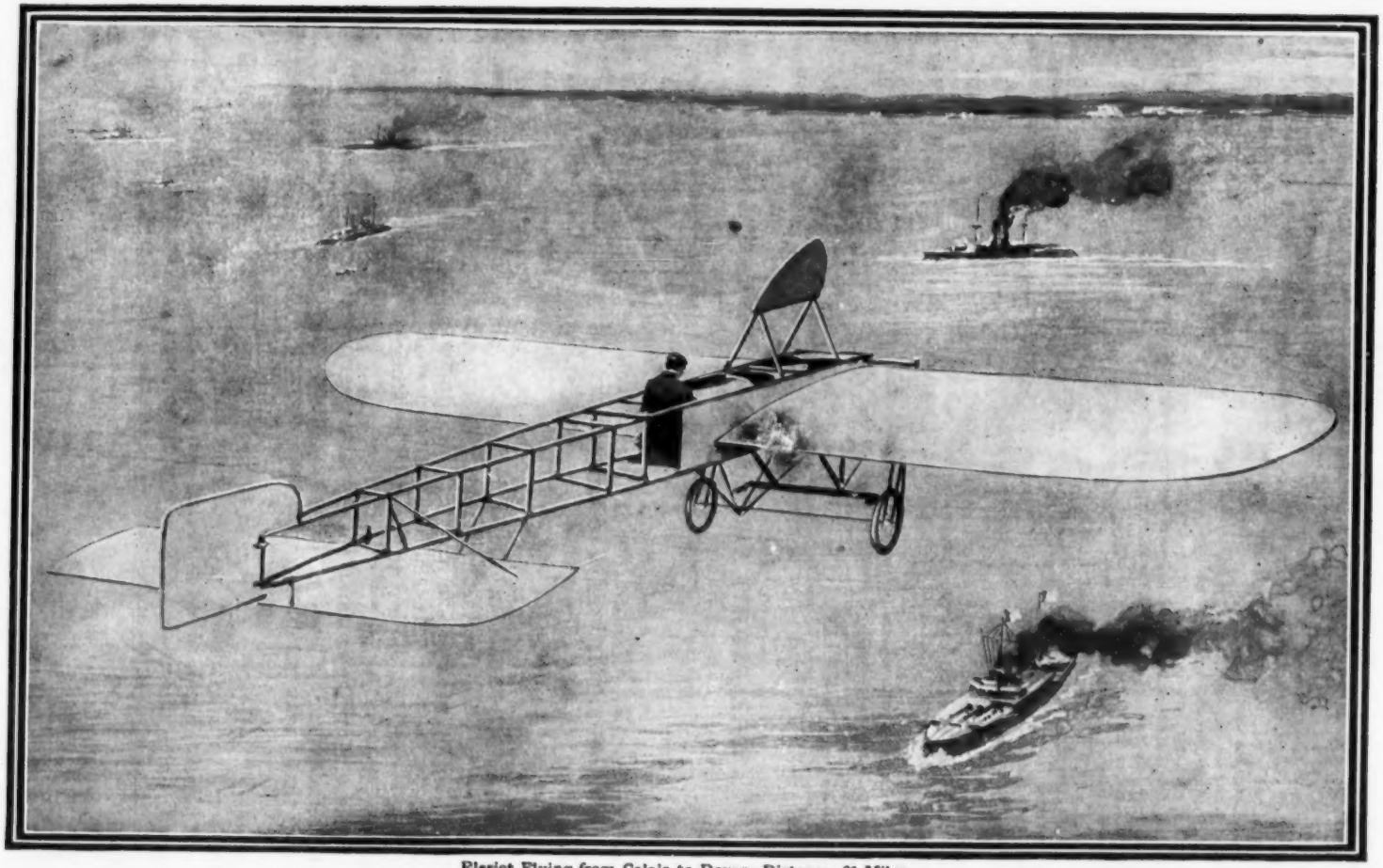
"At 4:35 in the morning the signal was given, and in an instant I am in the air, my engine making 1,200 revolutions, almost its highest speed, in order that I may get quickly over the telegraph wires along the edge of the cliff. As soon as I am over the cliff I reduce my speed. There now is no need to force my engine. I begin my flight, steady and sure, toward the coast of England. I have no apprehensions, no sensations.

"The French torpedo boat has seen me. She is drawing ahead at full speed. She makes perhaps 26 miles an hour. What matters? I am making at least 42½ miles. Rapidly I overtake her, traveling at the height of 250 ft.

"The moment is supreme, yet I surprise myself by feeling no exultation.

"Below me is the sea, its surface disturbed by wind, which now is freshening. The motion of the waves beneath me is not pleasant. I drive on.

"Ten minutes have gone. I have passed the destroyer and I turn my



Bleriot Flying from Calais to Dover—Distance, 21 Miles

WINGS

By CHARLTON LAWRENCE EDHOLM

The hand of man, emerging from the mist
Of primal ages, was a hairy fist,
All blood-bedabbled; for the hand had killed
Before it learned to sow and reap and build.
So each new tool was but a weapon, fit
To add new terrors to the blow of it:
The first rude axe was formed for bloody deed,
Split skulls before it served the builder's need.
And thus through ages runs the tale; by worst
Of uses is the new-found tool accurst,
Yet we believe what prophet's words record,
That into plowshares men shall beat the sword.

For centuries we stood upon the edge
Of space and yearned, while sparrows from the hedge
Took flight and taunted us. "That I had wings!"
'Mid stormy music, thus the Psalmist sings,
"Then would I fly away and be at rest."
And lo, the wings are ours, a gift, the best
The genius of our race has forged; a tool
Fit for our eager age. What says the fool,
The War-brute? "This is *mine*, for brawls and strife,
As hawk-wings are the hawk's—for taking life!"

Well, claim them, War-god! Use them till the race
Will kill for you no more. What narrow space
Holds man today apart from brother man,
A range of rock, a river or a span
Of channel; and our wings shall overleap
These dwarfish landmarks. *Then* what king shall keep
His folk from merging with humanity
As waters intermingle in the sea?

Sail forth, winged Argonauts of trackless air,
And as upon your homeward course you fare
Bring heav'nly treasure. Neither gold nor steel,
Nor gross and earthy wealth weight your light keel;
Man's Brotherhood, bring *that* as Golden Fleece
On sun-blest wings, bright harbingers of peace.

head to see whether I am proceeding in the right direction. I am amazed. There is nothing to be seen, neither destroyer, nor France, nor England. I am alone. I see nothing at all. For ten minutes I am lost. It is a strange position, to be alone, unguided, without a compass, in the air over the middle of the channel.

"I touch nothing. My hands and feet rest lightly on levers. I let the aeroplane take its own course. I care not whither it goes. For ten minutes I continue, neither rising nor falling nor turning, and then, twenty minutes after I have left the French coast, I see the green cliffs of Dover, the castle, and away to the west the spot where I intended to land. What can I do? It is evident that the wind has taken me out of my course. I press a lever with my foot and turn easily toward the west, reversing the direction in which I have been traveling.

"Now, indeed, I am in difficulties, for the wind here by the cliffs is much stronger and my speed is reduced as I fight against it, yet my beautiful aeroplane responds. Still steadily I fly westward, hoping to cross the harbor and reach Shakespeare cliffs. Again the wind blows. I see the opening in the cliffs.

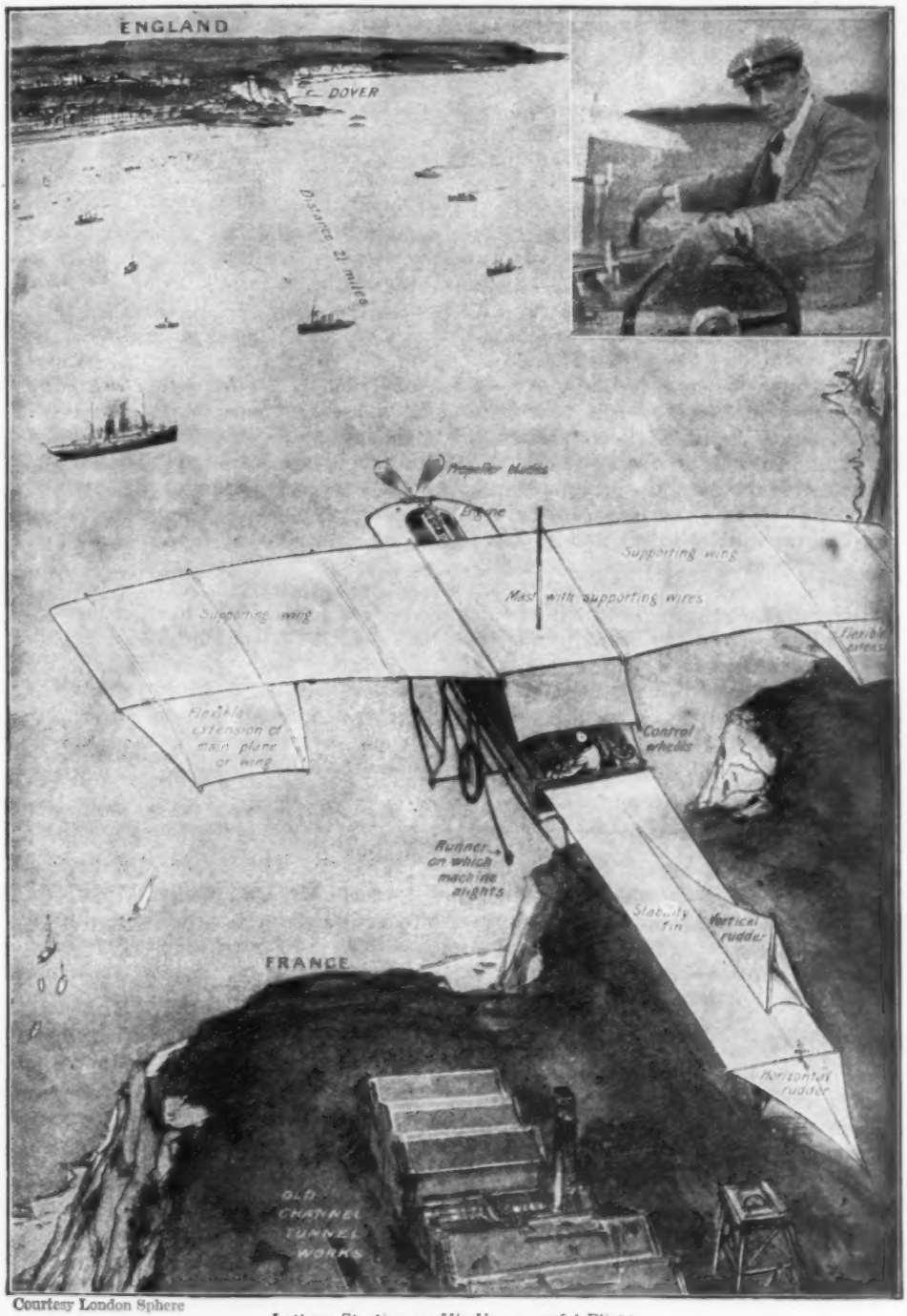
"Although I am confident that I can continue for an hour and a half, and that I might, indeed, return to Calais, I cannot resist the opportunity to make my landing upon this green spot. Once more I turn my aeroplane and, describing a half circle, I enter the opening and find myself again over dry land. Avoiding the red buildings on my right, I attempt a landing, but the wind catches me and whirls me around two or three times. At once I stop the motor. Instantly my machine falls, straight upon the land, from a height of 65 ft., in two or three seconds, and my flight is safely done."

The Bleriot aeroplane is a monoplane of the "Antoinette" type, and is one of the smallest flying machines of its kind ever used. Its wings are no more than 20 ft. across, it weighs but 400 lb., and it is driven by a 25-hp. engine. His speed across the channel averaged 45 miles an hour, and he ended his flight a little less than half an hour after he started. About 250 ft. above the sea level was his average height. The few people on the Dover cliffs saw the machine coming through the air like a gigantic hawk. As it approached the cliff it seemed to grow larger instant by instant. Bleriot swooped over head, glancing from right to left, and then turned his machine to the east and came to the ground in a meadow.

HERBERT LATHAM'S BRAVE ATTEMPT

Herbert Latham's first attempt to make the crossing, in which his machine dropped into the channel when only a little more than a mile out, gave Bleriot his opportunity, and Bleriot's triumph was Latham's tragedy. When the long-awaited favorable moment arrived Bleriot was ready and started while Latham was asleep. Levavasseur, Latham's companion, was watching the weather for him, and at 2 o'clock and again at 3 o'clock left his bed, only to shake his head at the wind and return to sleep.

About 4:30 he went out again and overheard a remark to the effect that Bleriot had started. At the same moment he saw a dark spot traveling over the sea. It was already several miles away. Latham's distress when he was awakened was intense. He brushed away hot tears of disappointment more than once and finally broke down and wept openly. The wind had strengthened, and pursuit being impossible, all he could do was to send a wireless message to Bleriot, saying: "Cordial congratulations. I hope to follow you soon."



Courtesy London Sphere

Latham Starting on His Unsuccessful Flight

Although the prize had been won and the opportunity of being the first to cross the channel was also lost to Latham, his desire became to show the world that he could fly to Dover and perhaps to London.

Consequently, on July 27, he made the attempt which came so near to victory, yet ended in another bitter defeat. When he started from Calais the wind was just right, although it was raining slightly. He rose to a height of 500 ft. and darted away like a hawk, and although victory came not, the flight at the moment of its sensational finish in some respects eclipsed Bleriot's. He made a great speed, being only 20 minutes in the air from the time he started until he dropped into the channel less than two miles from the coveted goal, his altitude was much greater, and through it all was the rain.

The disastrous ending of the flight furnished a dramatic scene. Shortly before 6 o'clock in the morning the clamor of sirens and bells on the ships in the harbor notified Dover that another flight was being attempted. In a marvelously short time the water front, the piers, and the cliffs behind the town were crowded. Soon two French torpedo boats, which preceded the aeroplane, were seen approaching at a furious pace, thick clouds of smoke puffing from their funnels. A little less than 15 minutes after six o'clock the machine was seen approaching, and the rapidity of its flight was evidenced by the quickness with which it grew larger and assumed birdlike outlines. Suddenly it began to slacken speed, at the same time gliding toward the surface of the ocean. It fluttered a few times, then fell like a wounded eagle.

The force with which the aeroplane had fallen caused fears that Latham might have been killed in the wreck if he had not been drowned, but signals from the ships finally told those on shore that he had escaped, although injured.

The cause of the accident, as in the first attempt, was due to the engine failing. Latham received a severe gash on the forehead and the nose, but was not otherwise seriously harmed. He expressed his determination to make another try as soon as he and his machine were repaired.

THE TRIUMPH OF GLEN CURTISS

Through the furor of the past few months over the flights of the Wrights in Europe, their home coming, and the flights at Fort Myer, the people of America in general naturally lost sight of the fact for the time being that there were other aviators in the country hard at work experimenting and developing other aeroplanes. Dwarfed into insignificance by the long flights of Wilbur and Orville Wright, a period of three or four minutes in the air, considered a great accomplishment not much more than a year ago, drew but little attention except from those who saw in such small successes the sure promise of greater flights. But that taking serious consideration of the one- and two-minute flights is wise for those really interested in the advancement of aerial science has been proven in one instance at least: that of Glen Curtiss, who, on July 17, flew his aeroplane through the air for 52 min., 30 sec., and covered a distance, over a measured course, of 24.7 miles. In this flight he proved himself a serious contendent of the Wrights for aerial honor in America, and one of the foremost aviators in the world.

The flight took place at Hempstead Plains, Long Island. He arose into the air at 5:23 o'clock in the afternoon, and during the entire flight had the machine under perfect control. At times he whirled around the circular course at a speed of over 45 miles an hour, often descending as

Curtiss in the Machine that Flew 52 Minutes

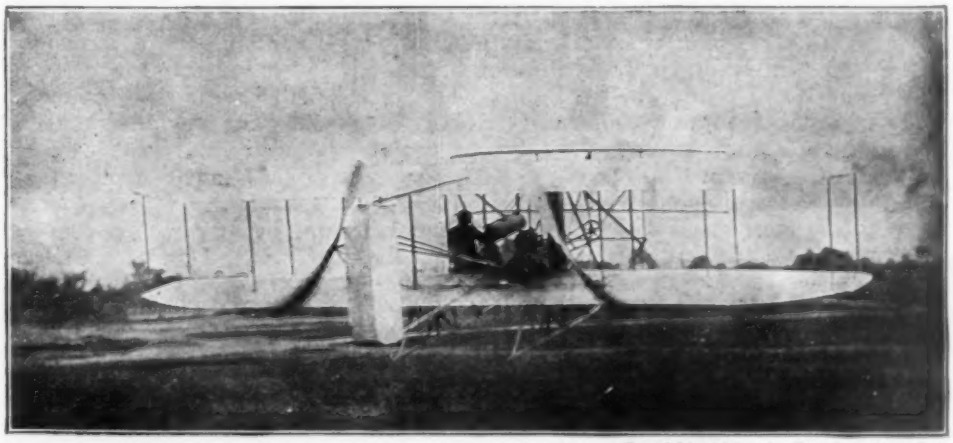
low as 18 ft. and rising as high as 60 ft. At the beginning of his twentieth round he encountered a strong head wind, and, fearing that his gasoline supply would fail before he could make another lap, he shut off the engine and descended.

The successful flight was his last in this country until his return from Europe. His mission abroad is to enter the aeroplane races at Rheims the latter part of August for the International Gordon Bennett cup and other prizes. The following day the machine was wrecked by amateur aviators of a New York aerial club, to whom he had sold it for $5,000.

EFFORTS OF THE WRIGHTS

The early efforts of the Wrights this year at Fort Myer to fulfill the requirements of the United States government were undoubtedly disappointing to people interested in the science all over the country as well as government officers and members of the signal corps of the army.

Not until late in the afternoon of July 28 was anything accomplished that compared in any way with the wonderful flights made last year in America and in France. On that date Orville Wright, with Lieut. Frank P. Lahm as a passenger, broke the world's aeroplane record for two men, both for speed and distance, remaining in the air 1 hr. 12 min. 40 sec., and



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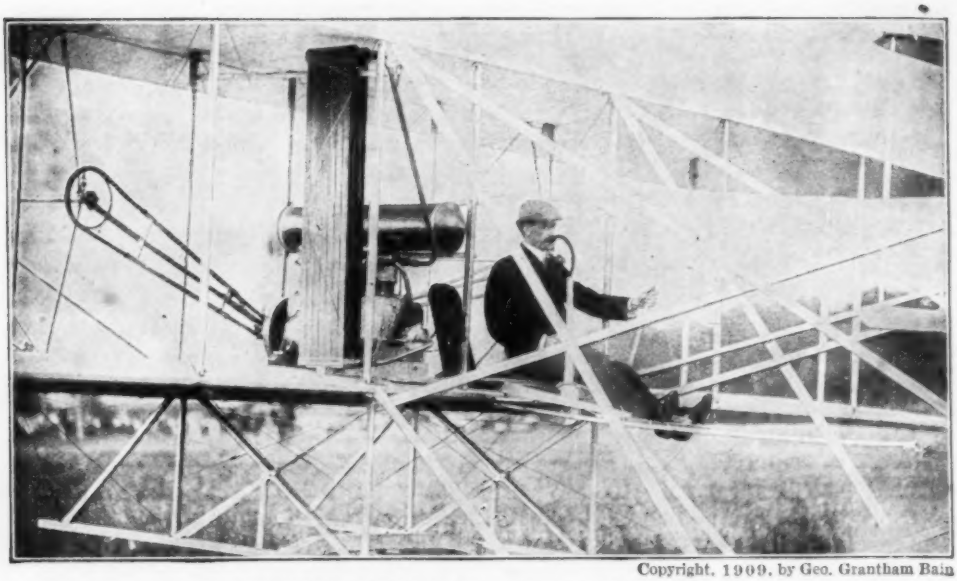
Orville Wright Leaving the Ground at Fort Myer



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Orville Wright Manipulating the Controls of the Machine

covering upwards of 50 miles at a speed averaging about 40 miles an hour. By the flight, the Wrights succeeded in placing behind them one of the two crucial tests imposed upon them—the so-called "endurance test," which required that the machine stay in the air one hour with two persons. The other test (by the time the public receives this magazine undoubtedly over) is a flight over a measured course of 5 miles and return at the speed of at least 40 miles an hour with one passenger.

The long flight of July 28, as usual this year, was "weather permitting," and followed a long wait. Just before sunset there was a sprinkle of rain and after that the wind died down. Shortly after six o'clock Orville Wright signaled for the aeroplane to be trundled to the starting derrick. At 6:30 Lieut. Lahm took his seat in the center of the machine by the side of the purring motor. It was the place that his friend and fellow student in army aeronautics, Lieut. Selfridge, took 10 months ago and met death. At 6:35 Orville, pulling his cap tightly over his brow, looked up and laughed at Lahm, and then took his seat at the outside, at the officer's left. At a signal from Wilbur Wright the word for the start was given, and the aeroplane, shooting swiftly down the incline of the monorail, soared into the air.

Round and round the aeroplane went, circling the great drill ground 74 times. Sometimes the circles were short, but usually the machine skirted the edges of the boundary at a height varying only slightly, save where some stray current of air from between the trees or buildings rocked it up and down or from side to side like a boat in a gentle sea.

As the hour drew to its close, excitement became intense. A thousand watches were out and eagerly scanned. At the conclusion of the seventieth round a great shouting, mingled with the "honking" of auto horns, notified Orville that he had stayed in the air an hour. President Taft, one of the most interested of all the watchers, joined in the applause. Still the machine continued its circles, gradually coming lower and lower until it was within 10 ft. of the ground. Then it was stopped almost upon the identical spot where Lieut. Selfridge fell to his death last year, and Lieut. Lahm and Orville Wright stepped safely from it. It was Orville's first successful flight with a passenger and he admitted being a little nervous at first.